PUBLIC WORKS

Jan. 1954

CITY, COUNTY AND STATE

Special Section on

HOW TO MAKE OLD ROADS FIT FOR TO-DAY'S TRAFFIC

Labor Saving Equipment for the Water Department

Sewage Treatment Economics for Sacramento, Calif.

Six Ways the Roughometer Helps in Highway Work

A Far North Water System—Fairbanks, Alaska

Repairing a Bridge with Air-Applied Concrete

Ground Water Pollution and Waste Water Reclamation

William H. Weir, in charge of stream pollution control for the State of Georgia, is one of the country's leading engineers. More data on page 22.

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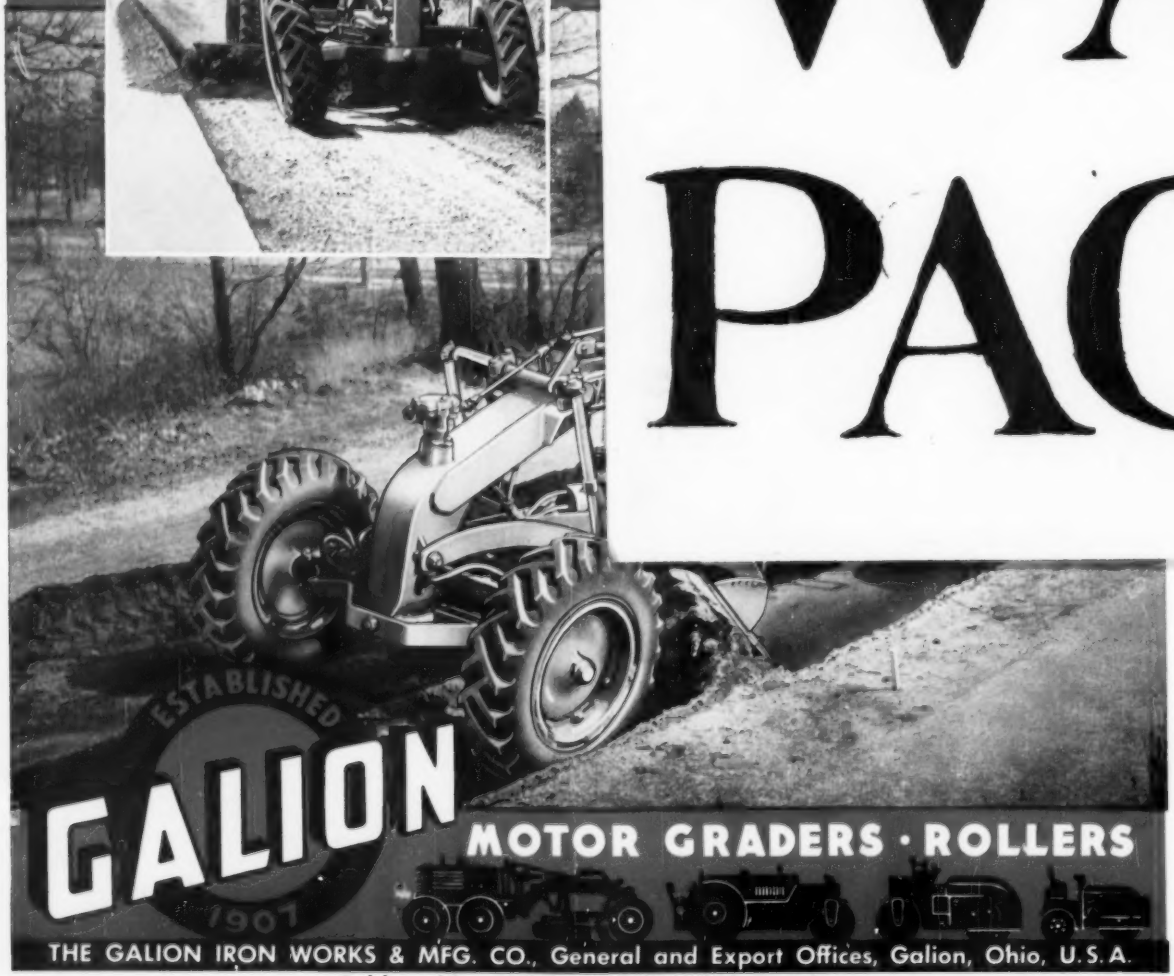

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CHICAGO SEWAGE EQUIPMENT

WIDE-BAND AIR DIFFUSION SYSTEMS

For Maximum Effectiveness of Sewage Aeration

16 tanks at Los Angeles, California, Hyperion Sewage Treatment Plant.
f Public Works and Metcalf & Eddy, Engineers

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❷ Swing Diffusers are installed in 95% of all Sewage Treatment Plants requiring aeration built since 1940.

❸ Swing Diffusers are installed in such large cities as New York, Los Angeles, Chicago*, Philadelphia, Boston, Cleveland, Omaha, Syracuse, Columbus, Oklahoma City, Boise, Madison, Altoona, Indianapolis, Lansing, Charlotte, N. C., and many others.

**Installed for channel aeration*

❹ Swing Diffusers were installed in both new plants and in existing plants to increase aeration capacity and efficiency without construction of additional tanks.

❺ Swing Diffusers exclusively provide highest aeration capacity and accessibility of diffusers without interruption of aeration, making unnecessary the construction of stand-by tanks.

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The City of Los Angeles, Board of Public Works and Metcalf & Eddy, Engineers

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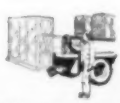

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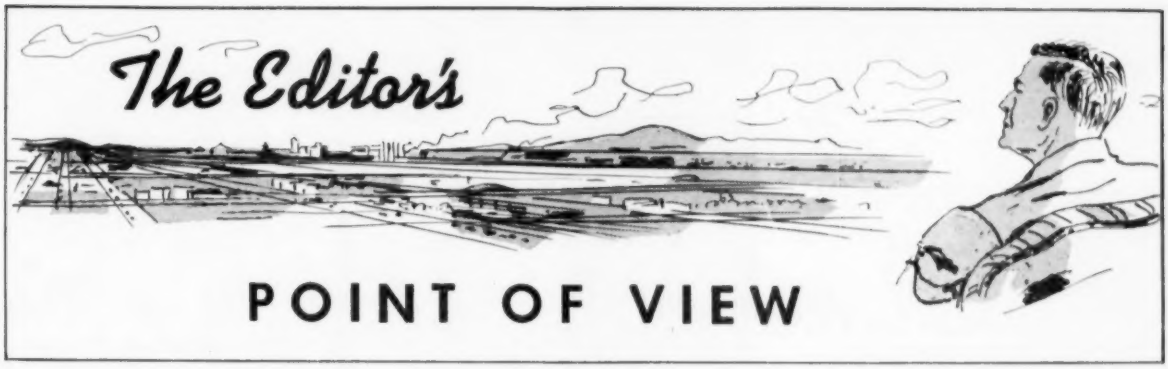

WITH the deepest regret and sense of loss, Public Works announces the untimely death of Croxton Morris, Vice President and Manager, on December 18. We shall miss him greatly, as will very many outside of this organization who have had the privilege and pleasure of working with him. He contributed much to Public Works and, in his absence, we shall go forward, as he would have liked, to make this an ever-better publication.

Tunnels Under Streets May Solve Many Utility Problems

METHODS of tunnelling under city streets have been described in several recent articles submitted to us. Tunnels may solve many problems, as where greater sewer, water or storm drain capacity is needed. It may cost less to build a tunnel under a street in which all these utilities can be placed than to dig up the street and put in a single large water main, sewer or drain; and there is practically no interference with traffic using the street—an important factor.

Mining methods are being studied in an effort to reduce costs of tunnelling and new types of equipment for handling the spoil are being tried out. Some of these methods will be described in forthcoming issues of this magazine. We believe this new trend is a worthwhile one that may reduce the headaches incident to the growing pains that so many cities are suffering from.

Old Roads or New?—A Tough Problem to Solve

EVERYONE agrees that our present highway system must be modified to take care of the traffic demands being made upon it. However, there is a sharp difference of opinion concerning how this is to be done. One group advocates throwing the old road or street away and building new from the ground up. Another, and larger, group wants to save what we have and widen and strengthen these roads to take care of the existing traffic.

There is much to be said on both sides and probably the best answer is to use both methods. Certainly, toll roads like the Pennsylvania and New Jersey Turnpikes have shown that the public will pay willingly for entirely new highway facilities in special conjested traffic locations. Likewise, construction, such as the elevated highways around Manhattan and the new west side highway in Chicago, is necessary.

But to devote all available money to work of this kind, necessary as it may be, and neglect reconstruction on the much greater mileage of feeder roads and streets would invite worse traffic problems over a wider area.

Deciding on the proper division of available funds between entirely new construction and rehabilitation of existing pavements is one of the tough problems of the highway administrator. In making such decisions, all of the existing data must be studied and evaluated.

Once in a While We "View with Alarm" and This is a Time

FROM time to time people come up with new ideas for progress, whether in engineering or in other lines of work. Sometimes, of course, these ideas are not sound. Influenced by this, too many engineers tend arbitrarily to come up with a "no" to new ideas. This procedure we view with alarm This country did not get to its present point by thinking negatively or acting negatively. When we get to the point that we do these things, progress will stop.

The thing we are thinking about quite specifically is the matter of using enzymes as an aid in sewage treatment, though what we say applies to many other products and numerous fields of engineering. We do not know how valuable enzymes will turn out to be. There is one way to find out and that is by trying—not talking. It isn't going to hurt any city very much to try out this process if they think it will do good; nor is it going to cost very much. From these actual trials and tests we may find something really valuable.

Let's be open-minded; careful, yes, but not reactionary. All progress has not ceased, nor have all the good ideas been thought of. It is easy to say "no" to a new idea, and easier yet to poke fun at it. But it doesn't get very far.

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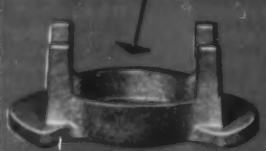
• Arch-type base extends well below curb stop and rests on foot pieces or rigid foundation.

• The H-10316 Curb Box, used with curb stops ½" through 1", and the H-10336 Curb Box, used with curb stops 1¼" through 2", have optional foot pieces which offer close fitting support for curb stops and centers them in the curb box.



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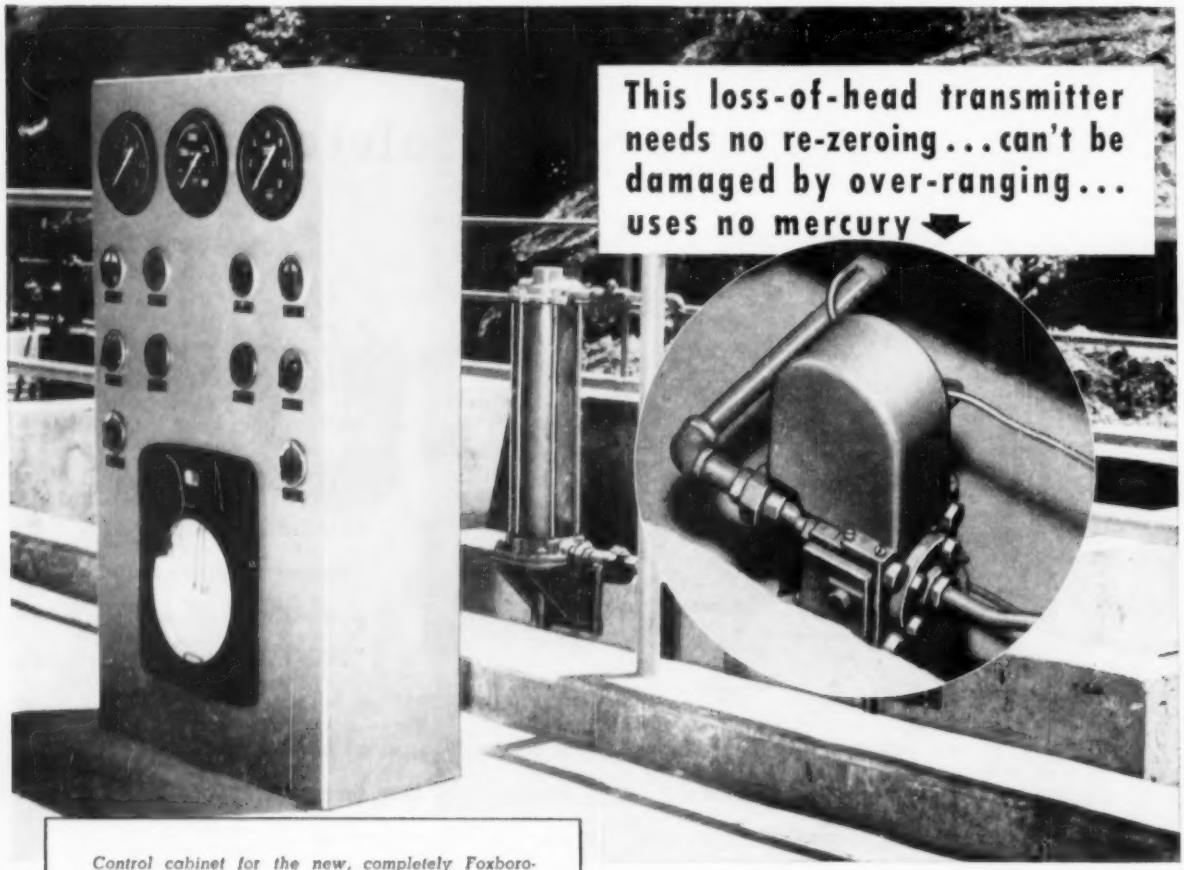

Control cabinet for the new, completely Foxboro-instrumented plant of the North Marin County Water District. Two outside gauges at top of panel indicate d/p Cell measurement of loss-of-head. "Easy, economical operation plus neatness" are outstanding advantages of d/p Cell Transmitters cited by plant. Other controls on panel are for effluent rate and backwash. Consulting engineers: Clyde C. Kennedy, San Francisco.

The new water treatment plant of the North Marin County Water District, Novato, Calif., is realizing substantial maintenance savings by using Foxboro d/p Cells to measure and transmit loss-of-head.

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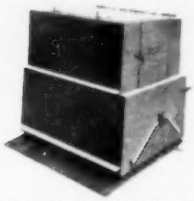

Universal Type Container is available in 4 to 12 cu. yd. capacities with or without top lids.

Apartment Type is available in 4 to 10 cu. yd. capacities. Note Sump Bottom, also available in Universal, Standard Drop Bottom and Drop Bottom Pressed Steel Type containers, for handling moist rubbish.

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Standard Drop Bottom, available in 2 to 10 cu. yd. capacities, is ideal for many materials handling uses.

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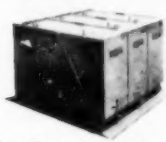

Multi-Karry Container comprises a master 6 cu. yd. container with three 2 cu. yd. box-like containers on casters. Each of the 2 cu. yd. containers may be rolled to a trash accumulation point. When loaded they are returned to master container and all three taken to dump and emptied by truck-mounted Dempster-Dumpster.

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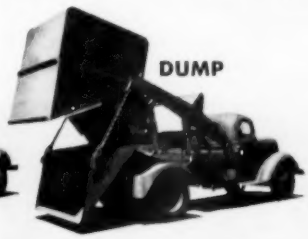

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St. Louis, Missouri
SALEM GAS LIGHT COMPANY
Salem, Mass.
WATER DIVISION, Dept. of Engineering
Syracuse, New York
THE CONSUMER'S GAS CO. OF TORONTO
Toronto, Ontario
DEPT. OF PUBLIC WORKS
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CITY OF UTICA, BOARD OF WATER SUPPLY
Utica, New York
CITY OF WHEELING WATER DEPT.
Wheeling, West Virginia
WILMINGTON WATER DEPT.
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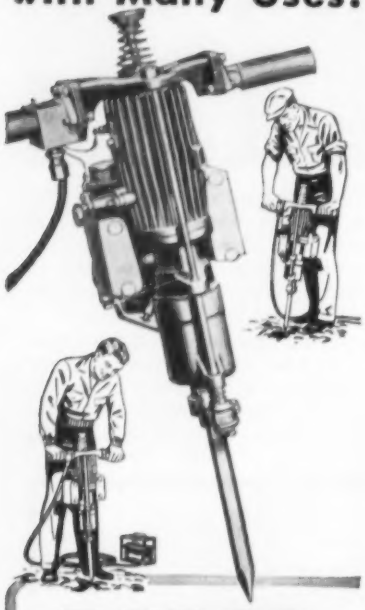

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■ HERE'S why owners of the *improved* Barco Gasoline Hammer are enthusiastically acclaiming it as *"A Profitable Tool With Many Uses!"*

- Versatile! Use it for Pavement Breaking . . . Cutting . . . Digging . . . Rock Drilling . . . Frost Breaking . . . Rod Driving. Ideal for general utility, standby, and emergency service.
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***Ask For This New* BULLETIN 613**

UP FRONT FOR ADEQUATE ROADS

BY

LEO J. RITTER, JR.
New York University

Winter Driving — Now, when we are right in the middle of the winter season, seems to be a good time to repeat the words of wisdom of the Committee on Winter Driving Hazards of the National Safety Council. The six basic rules of the Committee for safe winter driving are as follows:

(1) Get the "feel" of the road. Try your brakes occasionally while driving slowly and away from other traffic, to find out just how slick the road is.

(2) Slow down. Adjust your speed to road and weather conditions so that you can stop or maneuver safely.

(3) Keep your windshield clear. Be sure your headlights, windshield wiper blades and defrosters are in top-notch condition.

(4) Use tire chains on snow and ice. They cut braking distances as much as 450 percent and increase needed traction for acceleration as much as 450 percent.

(5) Pump your brakes to slow down or stop. Jamming them on can lock the wheels and throw the car into a dangerous skid.

(6) Follow at a safe distance. Remember that, even with tire chains, it takes from 2 to 6 times as far to stop as it does on a dry concrete pavement.

Traffic safety is, after all, a personalized thing. You can do your part by driving sensibly and sanely under all conditions. We like the advice given by one of the local TV broadcasters (Tex Antoine), "Give an inch and take a smile."

Piggy-Back Plan—Sharp opposition is developing in various quarters to renewed proposals for "piggy-back" combined service of truck trailers and flat cars, which have been featured in the technical and non-technical press in recent weeks. Apparently much of the furore has grown out of recent demonstrations by the Electro Motive Division of General Motors of a system which employs very large flat cars, each of which is capable of hauling two full-sized trailers. Proponents of the plan have made a big thing of claims that its adoption would greatly reduce traffic congestion on the nation's highways. The "ballyhooing" of this questionable feature of the plan was a matter of great concern at the recent convention of the American Trucking Association in Los Angeles. ATA's Executive Board passed a resolution which, among other things, viewed the tractor-on-flat-car proposals with interest, "but with even greater alarm because of the unrestrained claims of relief of highway congestion being made for this plan." The Executive Committee did, however, establish a special committee to conduct an intensive investigation of current activities relating to the plan.

Recently, also, a representative of the Traffic Executives Association of the Eastern Railroads pointed out the shortcomings of the plan in the Wall Street Journal. Among the points made was the fact that, unless the railroads bought enough equipment to make up complete trains of the special flatcars required, the element of high-speed movement would be lost and the trailers would move more slowly than competing over-the-road truckers. We look for the proposal to die an early death, although every consideration should be given to its practical possibilities.

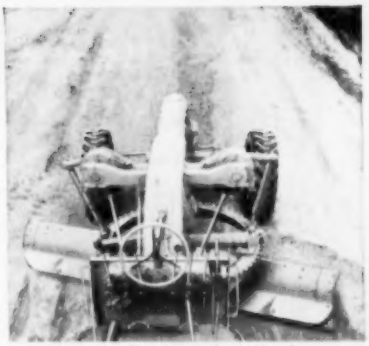
Highway Engineer Training in Michigan—Last summer saw the successful inauguration of a new training and recruiting program designed to help alleviate the shortage of trained engineering personnel in the Michigan Highway Department. This unique plan is a joint venture involving the Highway Department, the Michigan Road Builders' Association and the University of Michigan. The program is specifically designed to reach graduating high school seniors. Thirty carefully selected graduates attended an eight-

(*Continued on page* 124)

ALLIS-CHALMERS INVITES YOU TO . . .

Look at your Grader Jobs

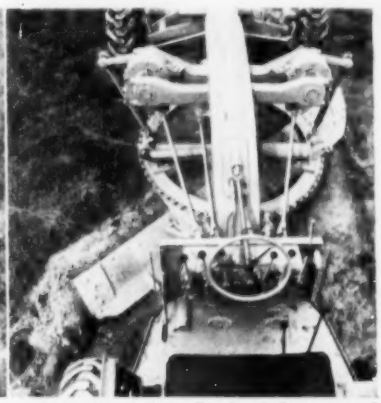
THROUGH THE EYES OF AN **AD-40** OPERATOR . . .



GRADING — Look at that single member frame — it really lets you see what you're doing . . . means efficient grading on *any* job.

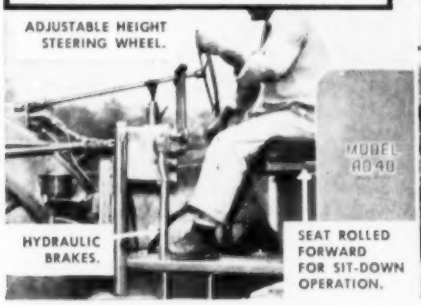
SLOPING — Look how much better you see . . . how much steadier your blade is with small control rods leading out to lift cases located directly over the circle.

DITCHING — Look at the low control panel. It gives you a clear view of the blade . . . helps insure a clean, smooth ditch.



SOD STRIPPING — Look at the tapered corners on this clean, wide platform . . . how they give unequalled view of heel of ROLL-AWAY moldboard.

In addition to letting you see better, the AD-40 offers feather-touch hydraulic power steering, hydraulic brakes . . . and true comfort for any size operator, sitting or standing. *Look!*



Yes, the big, new AD-40 is designed for today's jobs and today's operators . . . brings new standards of performance to all users of motor graders . . . handles all grading jobs faster, better, easier. You owe it to your operators . . . and yourself to ask your nearby Allis-Chalmers dealer now for a demonstration and *see for yourself.*

ROLL-AWAY is an Allis-Chalmers trademark.

- **104 bhp. • Six speeds forward, three reverse**
- **23,000 lb. (with optional calcium chloride solution in rear tires — 24,800 lb.).**

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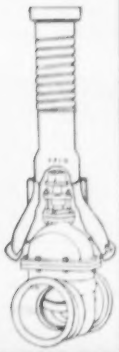
THREE PIECE

valve boxes supplied with separate bases are available in sliding or screw type. Made with 5¼" and 7" shafts with extensions as required. Also, a complete line of service and roadway Boxes.



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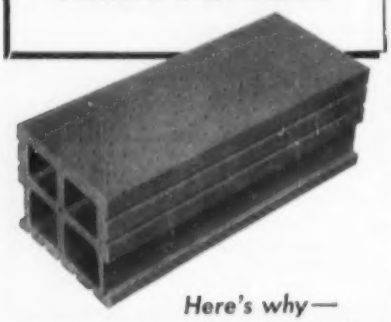

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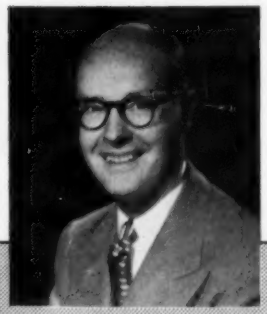


BY "DOC" SYMONS

H.T.M.A. — And let me be the *last* to wish you a Happy New Year and a Prosperous 1954.

★ ★ ★

Have You Heard? —Charlie Capen (AWWA Past Pres. and Chief Engr., No. Jersey Water Comm.) told this story about the late Art Clark, who preceded John Stewart as Mgr. of WSWMA.—

When Art was interviewed by the WSWMA, the committee asked him if he knew the difference between water and sewage.—"About five minutes", Art replied—and got the job.

★ ★ ★

Small World No. 23 — At the Federation meeting in October, I was wandering through the exhibits (as is my custom) and met Fred Biele, Cons. Engr. from Huntington, L. I. We were gabbing about my brother-in-law, whom Fred had known as a restaurateur in Huntington, some years ago, when along came Frank Flood, of Metcalf and Eddy and John S. Laboon, chairman of the Allegheny County San. Auth. in Pittsburgh. I introduced Fred to Frank and started to introduce him to John when they looked at each other and said "You're not—who worked for Chester and Fleming back in 1905?" In that year both had worked for that firm and Biele had designed the sewage plant for the city of Charleroi, Pa., now Laboon is consultant to the city and is designing improvements and additions.—Long time, no see— and Small World!

★ ★ ★

I Read Somewhere — Roman plumbers marked their names on piping and installations (much like modern contractors) to identify their work.

★ ★ ★

While down Florida way for the Federation Convention in Miami, I also attended the annual meeting of the Florida Section of AWWA. During some time off in the hotel lobby between papers, I had the opportunity to talk with Dr. James B. Lackey who is directing the studies on the causes and effects of the famous "red tide". So far the evidence is circumstantial that *Gymnodinium brevis* is the culprit, but when *G.brevis* appears in large numbers, fish die; the mechanism of the killing is unknown as no one has successfully grown the organism in pure culture, yet. Maybe Florida's Engineering and Industrial Experiment Station Project 5307 will solve the puzzle.—By the way, Jim, is this the same organism which made the Red Sea turn red?

★ ★ ★

Luminous Quote — From the pen of Robt. Louis Stevenson, "Someone has said, 'Of making books there is no end', and little knew how he praised letters as a profession."

★ ★ ★

Swedefinition — "Censure—The tax a man pays to the public for being eminent."

★ ★ ★

How do you pronounce it? — Up in New England there is a lake with the longest name in the language, perhaps even longer than some of the famous Welsh names. it is an Indian word, which liberally translated means, "You stay on your side of the lake, I'll stay on my side, and we'll both fish in the middle."—Maybe today's great nations could use a little of that idea.—For your information—the name is spelled, "Chargoggaggoggmanchaugagoggchaubunagungamaug".

I asked Dick Pearce, the Chlorinizer man from Builders-Providence, how to pronounce it. "Simple", he said, —"Lake Webster!"

★ ★ ★

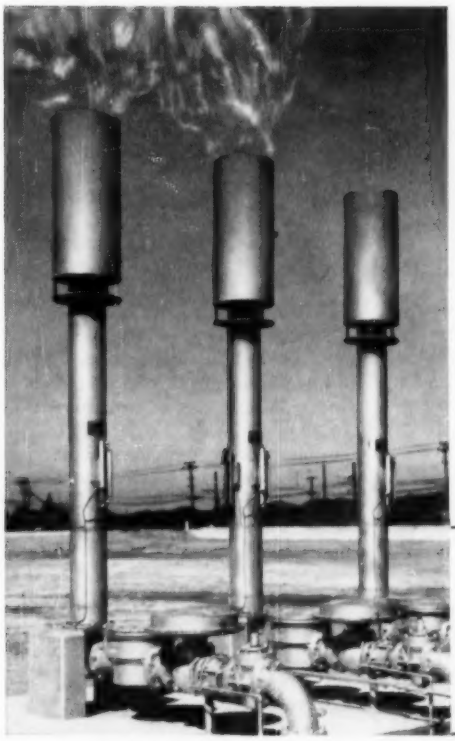
Puzzle —A fellow by the name of Schaphorst, a Mechanical Engineer

(*Continued on page* 110)

In the East Bay Municipal Utility District plant at Oakland, California . . .

excess gas is safely burned with

P. F. T. WASTE GAS BURNERS



At this plant serving communities in the Bay area, three 95 ft. diameter digesters produce more gas than is needed for digester heating. To avoid resulting odor nuisance, East Bay's engineers have had three P.F.T. 6″ Waste Gas Burners installed for safe, convenient elimination of excess gas.

For control and protection, each burner is equipped with a P.F.T. 4″ Pressure Relief Waste Gas Flame Trap, completely eliminating hazards.

In addition to this gas safety equipment, the following P.F.T. products are installed in the plant: 3 Floating Covers for the 95′ digesters; 3 Heater and Heat Exchanger Units (1,200,000 B.T.U./hr.); 3 Cover Position Indicators; miscellaneous gas control equipment.

Complete information and diagram of P.F.T. Gas Safety Equipment upon request—Bulletin 321.

Design of plant by / Engineers of East Bay Municipal Utility District

The P.F.T. Waste Gas Burner consists of a baffled burner pot mounted on top of an insulated pedestal. Burner pots are provided with adequate baffled air inlets to permit continuous operation of a gas pilot and provide for intermittent combustion of excess gas through a wide range of flows. The insulated pedestal minimizes formation of condensate and prevents freezing.

P.F.T.

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automatically adjust for wear!

HOMESTEAD Self-Seald LUBRICATED PLUG VALVES provide lower-cost-per-year fluid control than any other valves within their service range. Extra long, leakless service, less maintenance and lower operating costs are assured by the exclusive, *self-sealing*, wedge-acting, two piece plug that *automatically adjusts* to make up for wear as wear occurs, thus keeping the seating surfaces of the plug and valve body in constant contact to maintain a perfect, drop-tight seal. Add to this the extra advantage of a full lubricant seal around the ports and the top and bottom of the valve, and you have the reasons why HOMESTEADS' are noted for lower replacement and maintenance costs. Specify "HOMESTEADS" on your next valve job, or slip them in on your next replacement.

We can furnish them in semi-steel or cast-steel, 100% Port Area or Venturi, in sizes ¼" to 14", for steam working pressures to 150 lbs., or air—water—gas to 200 lbs. ***Also available in one piece plug design.***

Some "Self-Seald" Features

- Combines positive seating of tapered plug with operating ease of cylindrical plug.
- Leakproof triple head seal.
- Port area equal to 100% std. pipe area.
- All sealing surfaces protected from line fluids.
- Full threaded lubricant screw.
- Quarter turn opens or closes.
- Port position indicator.

MAIL COUPON TODAY for VALVE REFERENCE BOOK No. 39-5

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LETTERS TO THE EDITOR

SMALL-TOWN ENGINEERS

My question is: Why do you always point out as "Leaders in Public Works" only those who serve large cities, when you know as well as I do that there are more who are doing a grand job for the small towns, yet are never given any recognition by you. These men would like a pat on the back, too. Anyway, will you think about it?

A Reader

Reply: I am 100 percent in agreement with the anonymous writer who sent us this letter. The men in the small towns have to do their work without all the benefits of those in the larger places. It was our original intention to emphasize the small community folks and the younger men. For certain reasons, however, it has not always been possible to stick strictly to this, as we would like to do.

Though there are only twelve covers a year, we want to do justice to all. We hereby invite nominations from communities of not more than 25,000 population, preferably of the younger men who have done outstanding jobs in public works activities for their community. Address letters to: The Editor, Public Works Magazine, 310 East 45th St., New York 17, N. Y.

W. A. Hardenbergh
Editor

TO THE ENGINEER

Who comes with pencils pointed right?
The Engineer
Who comes with notebook gleaming white?
The Engineer
Who comes with transit shining bright,
With rods and poles of varying height,

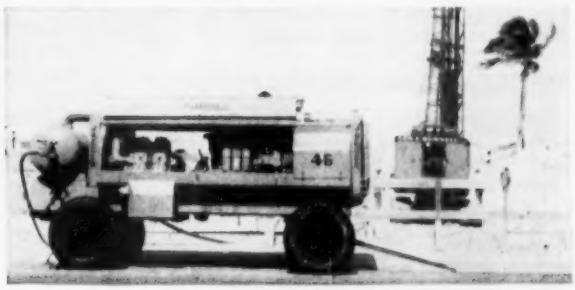
75 cfm puts full wallop in a heavy duty breaker.

With 125 cfm these tools do 30% 40% more work.

Three 365's — enough capacity for 4 heavy wagon drills.

More Jaeger air speeds many jobs, such as line testing.

Tractor mounted and powered, operates two big drills.



Ample air for heavy pile hammers, with a Jaeger 600.

To run air tools at top efficiency, Jaeger compressors are built to higher standards...

75 • 125 • 185 • 250 • 365 • 600 cfm

Any compressor that produces 15% to 25% more air than others, without racing, overheating or vibration, must be engineered to higher standards.

Jaeger, alone, has engineered these new standards into thousands of compressor units, whose design features are not found in any other line of portable compressors, *old or new*:

- Balanced 2-stage "W" type compressor in every model from 75 to 600 ft.
- 75% to 100% larger valves; larger intercoolers and air receivers.
- Positive force feed lubrication, standard.
- Relief valve for automatic drainage, standard.
- Automatic "Fuel Miser" standard on all models where speed control means worthwhile fuel saving.
- Bigger clutches than any other compressors; bigger engines operating at conservative speeds.

Ask Your Jaeger Distributor to Prove This: At prices actually less than those still asked for "old standard" compressors, Jaeger compressors provide 15% to 25% greater volume of air at the lowest known cost per cubic foot.

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Here's Proof—

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BEFORE restoration of concrete bridge by Kentucky State Highway Department. Note severe deterioration of concrete by spalling. First step, chipping; then sandblasting with Bondactor.

DURING OPERATION, Bondactor nozzleman applies shot concrete 1" to 5" thick, completing restoration of bridge abutment in one application.

AFTER restoration with a Bondactor, the bridge is up to rated load limits. Cost of new bridge was estimated at $25,000. Total cost of Bondactor operation—$3,500!

Kentucky State Highway Concrete Restoration Rig PAID FOR ITSELF IN NINETY DAYS!

That's right! The Kentucky State Highway Maintenance Department has a portable rig for repairing and maintaining concrete bridges which paid for itself in 90 days! The rig features the Model 1250-S Bondactor, used for concrete gunning, the Mix-Elvator — a dry mixer and elevator — and a 105 CFM air compressor mounted on a straight truck. Mr. T. J. Hopgood, Assistant Director of Maintenance says, "Our unit makes it possible to accomplish far more concrete bridge repairing than ever before on our annual maintenance budget."

The best part of this story is that you can do the same thing yourself! The Bondactor is proved in use for many public works applications: curb repairs, construction and repair of swimming pools, settling basins; bridge viaduct and overpass restoration; dam repairs; installation and repair of sewers; gun-grouting of sewer pipe joints; sandblasting.

Accept This Invitation!

Investigate this budget-stretching plan today. Full details on the Kentucky rig, the three models of Bondactors and the Mix-Elvator will be rushed to you upon request. Write, wire or phone today! State intended use and materials to be gunned.

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Who laid our railroad, mile by mile,
Plans our airport modern style,
Harnesses power from the river Nile?
The Engineer

Who plans for mining ore and coal?
The Engineer
From deepest shaft and stripping hole?
The Engineer
Who works his brain by day and night,
To show his boss he's very bright,
And then gets hell when he's not right?
The Engineer

Chas. J. Golden
West Pittston, Pa.

• • •

MECHANICS OF FLUIDS

This text is primarily concerned with the application of principles, regardless of the type of fluid, to all problems of flow, including: The effect of fluid weight and viscosity, resistance to turbulent flow in conduits, resistance to flow past immersed bodies, lift and propulsion, and effects of fluid compressibility. Rouse and Howe are the authors. Published by John Wiley & Sons, Inc., New York. 245 pp; $4.50.

REPORT OF BOMBAY WATER DEPARTMENT

K. B. Carnac, Hydraulic Engineer of the Bombay Municipal Corporation has sent us a copy of the Administration Report of the Water Works for the year 1952-53. This report gives a brief description of all of the operations of the Water Department. Also included are graphs, tables, maps and illustrations. The total consumption during the year amounted to 119,310,000 gpd.

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for PATCHES & TRENCHES with a . . .

SAVE TIME — MATERIAL — MONEY by "SAWING BEFORE BREAKING" with a . . .

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Save up to 50% in labor and material. Saw repair patches — water, gas, sewer and air line trenches in floors, streets, walks and highways. Save too, by sawing contraction joints in floors and highways . . . eliminate costly hand forming and spalling.

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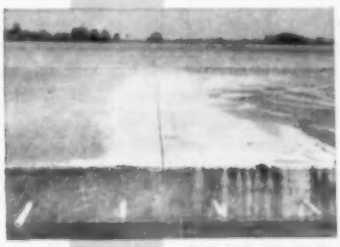
Only minimum replacement material needed and is poured to straight, smooth edges.

Sawed lines confine breakout fracturing and speeds removal up to 50%.



Contraction joints in floors or streets eliminates spalling, 50% less seal and are maintenance-free.

NEARLY 20 YEARS EXPERIENCE
Sawing Concrete of All Types

The unqualified Clipper guarantee of satisfaction is backed by world-wide experience, the ability to select the finest materials and the "know-how" to put them together.

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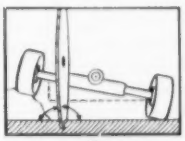
. . . guaranteed to . . . "Provide the fastest cut . . . at the lowest cost." Clipper alone can supply every necessary metal bond . . . in over 36 specifications.



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Starting in 1854 with the invention of the Rotary Positive Blower by our founder, Francis M. Roots, our company's services to industry were, for many years, devoted exclusively to air-handling problems.

As industry developed new applications of gases for fuels and chemicals, it was a natural step for us to move into this field because the general principles of moving and measuring air and gas are so closely similar.

Thus, Roots-Connersville service has been widened to include seven basic types of equipment . . . all devoted to the handling of either gas or air. The most recent development has been the new, amazingly efficient Spiraxial Compressor, first marketed in 1953.

So, for a century we have been engaged exclusively as specialists in handling gas and air. That is our only business. We like to think that this is one of the important reasons why R-C equipment has been so widely accepted in every industry where processing involves the movement of air or gas.

The growth which we have experienced over 100 years could not have been possible without the loyal support of our many thousands of customers. We thank them for this evidence of good will—and we offer the same high type of equipment and service to any industry that has a problem of moving gas or air.

Reg. U.S. Pat. Off.

ROOTS-CONNERSVILLE BLOWER

BLOWER BUILDERS SINCE 1854

A DIVISION OF DRESSER INDUSTRIES, INC.
154 Poplar Ave. • Connersville, Indiana

Centrifugal and Rotary Positive Blowers and Exhausters • Positive Displacement Meters • Vacuum Pumps • Gas Pumps • Inert Gas Generators • Spiraxial Compressors

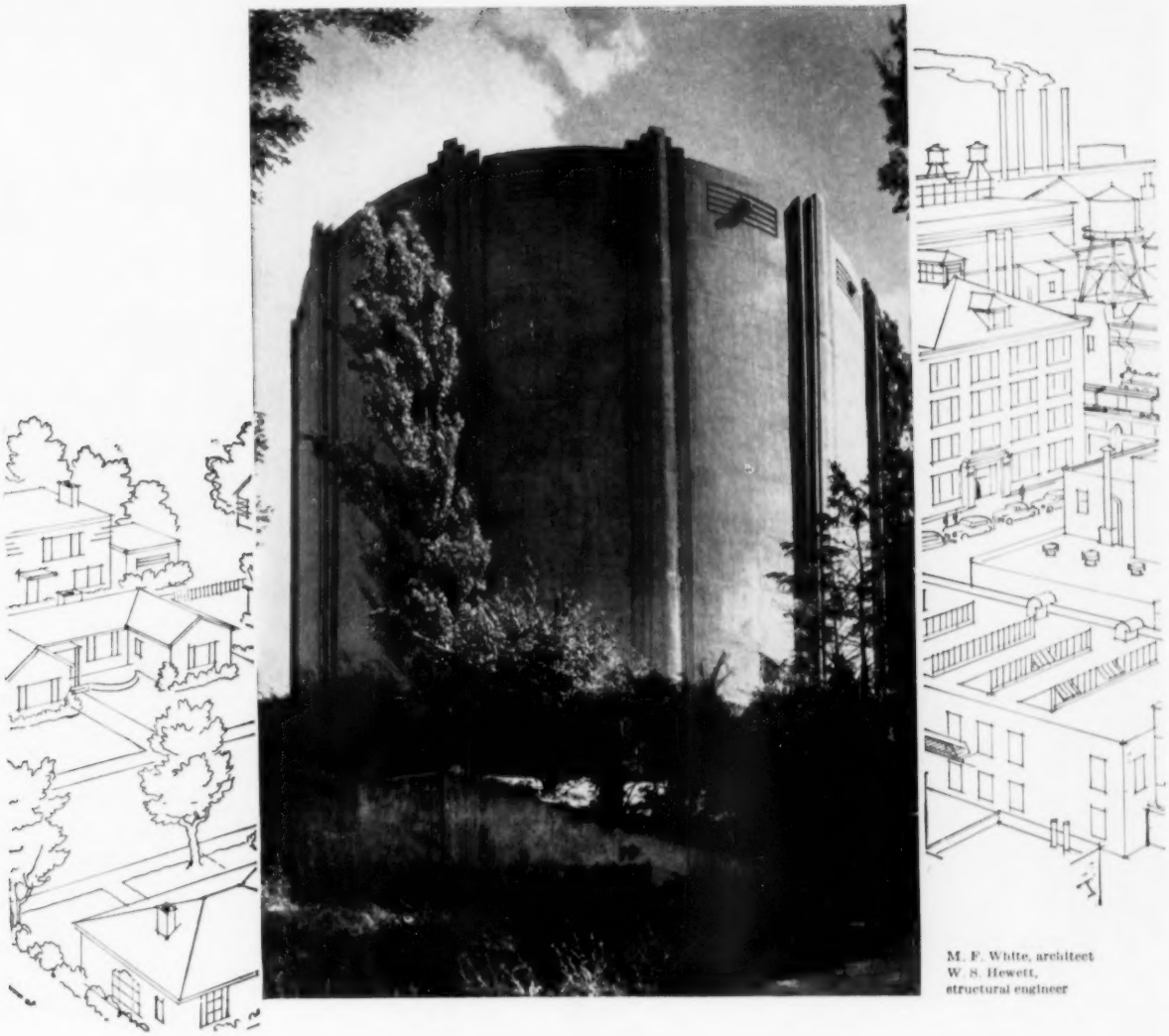
It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

LEADERS IN PUBLIC WORKS

★

William H. Weir, Director of Water Pollution Control for the Georgia Department of Public Health, has a long record of demonstrated ability and solid accomplishments. A graduate of North Carolina State College in 1924, he has been with Georgia's Health Department since 1928. Now a Colonel in the Army reserve commanding a research and development unit, he served in World War II as Lt. Colonel in the Sanitary Corps. In the service, he performed two outstanding jobs. One of these was the organization and administration with the Provost Marshal General, of the health protection program for our many thousand essential industries. Another was the development of and application of sanitary engineering procedures for combating biological warfare measures. In addition, he served at 6th Service Command HQ and elsewhere.

In his work in Georgia, he has been a leader in utilizing commercial agencies to promote industrial waste treatment; and he has promoted water and sewage operator training. He has received many honors and awards from the technical and professional societies of which he is a member — AWWA, FSIWA, Georgia Engineering Society, Georgia Public Health Association and Georgia Water & Sewage Association. These honors—all well-earned—are too numerous to mention here. He is extraordinarily capable, a fine man and a credit to the engineering profession.



M. F. White, architect
W. S. Hewett,
structural engineer

FOR WATER TANKS OF DISTINCTION

CHOOSE *CONCRETE*

A WELL-DESIGNED concrete water tank such as this 675,750 gal. water tank in Waukesha, Wisconsin, not only is a distinctive landmark but has long-lasting utility as well. It was built in 1934 and has required no maintenance.

Any city, large or small, can obtain lasting benefits by building such a reinforced concrete water tank. Its sturdy construction gives it the durability to withstand the weathering action of any climate. Its enduring beauty makes it a structure of which the entire community always can be proud.

A reinforced concrete water tank can be erected in practically any location without marring the skyline or depreciating the appearance or value of the property in the area.

Best of all, reinforced concrete water tanks are more economical than other types. They require little or no maintenance. They retain their distinctive appearance over their long life. And they render ***low-annual-cost*** service—the true measure of construction value. Such service pleases taxpayers, engineers and municipal officials alike.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

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For better trickling

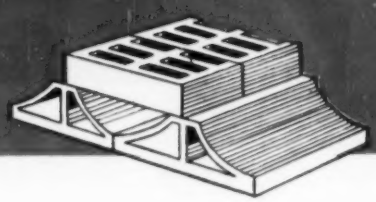
USE TFF INSTITUTE SPECIFICATION UNDERDRAINS

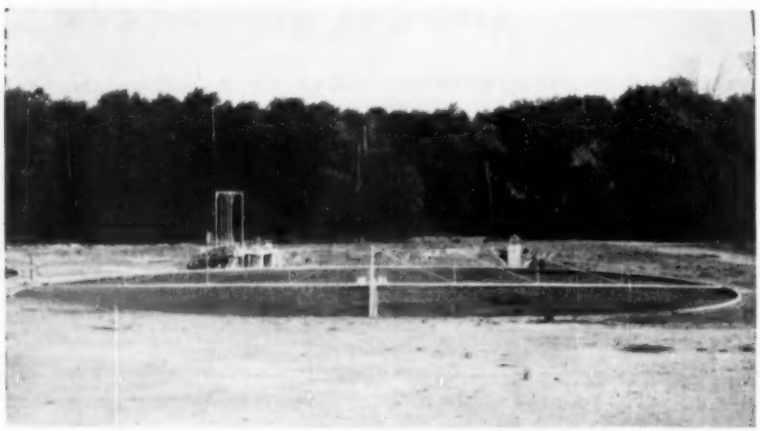
The scientific design of these *vitrified clay filter bottom blocks* insures trouble-free operation for the life of the filter. They have large top openings. That means proper ventilation of all filter media and free discharge of the filter effluent at all times. They have smooth run-off channels. That means quick drainage and no clogging even with years of operation. The blocks are light in weight, self-aligning and easy for unskilled labor to lay. After they have been laid they are strong enough to work on and to support even very deep filter media.

These modern underdrain blocks will carry applications up to 50 MGAD. They are best for all kinds and shapes of filters. They are used everywhere better operating results are desired.

Use them to insure best results from your next trickling filter. Give it a *specification* floor. Use TFFI *vitrified clay filter bottom blocks*. For full engineering details write any member of this Institute today.

IMCO

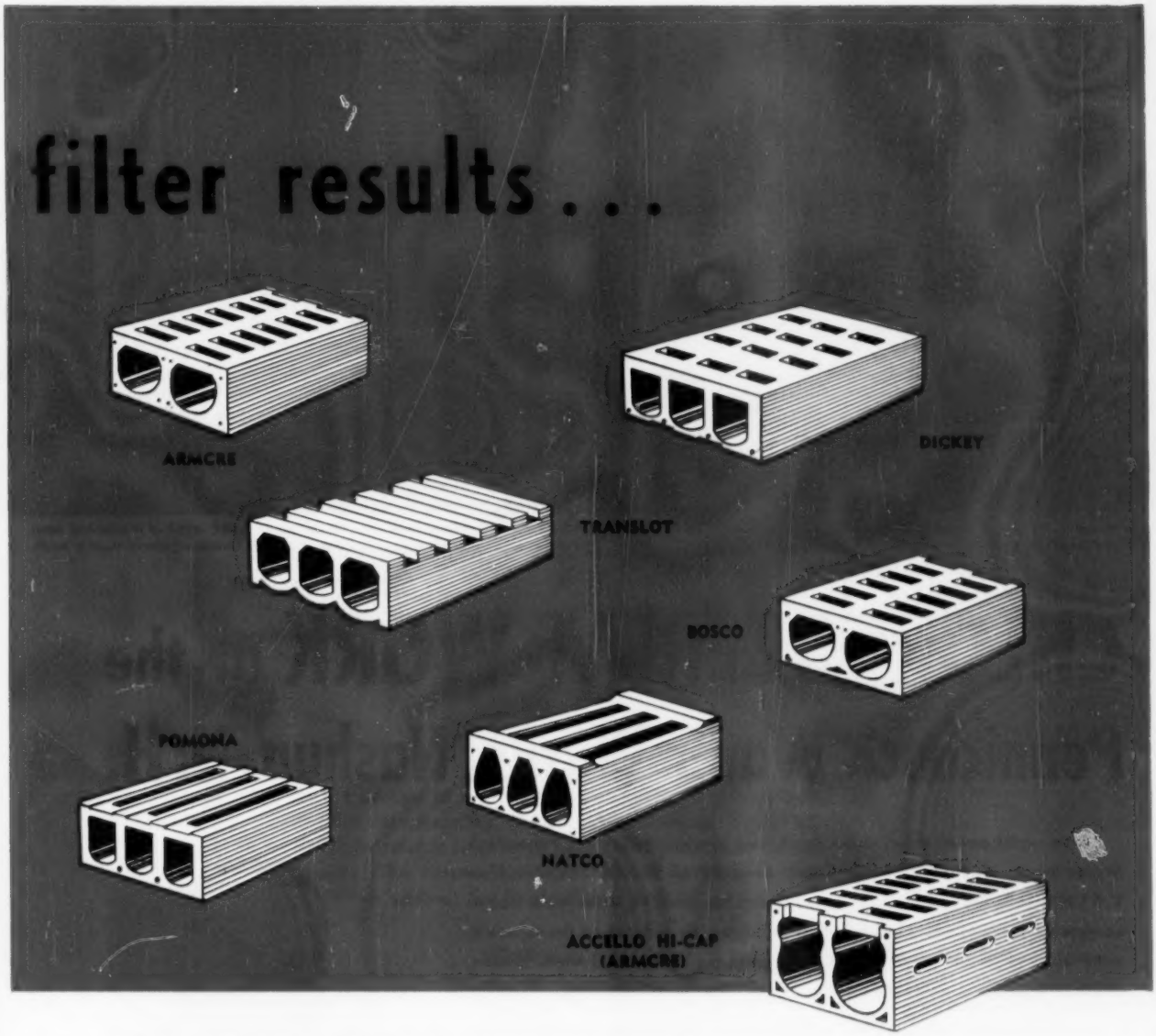




Courtesy The American Well Works

For more details circle No. 20 on the Readers Service Card

filter results . . .



——Another TFFI Installation . . .

La Grange, Ga. One of the American Well Works Rotary Distributors recently installed at the La Grange sewage treatment plant. Diameter of filters 167 feet. Type of Rotary Distributor "American" 20″ RH each with four 10″ arms. Maximum flow, 2,600 GPM each distributor. Consulting Engineers: Wiedeman and Singleton, Atlanta; Contractor: S. J. Curry & Company, Albany, Ga. Population served: 25,000.

If you don't have a copy of the 1954 "Handbook of Trickling Filter Design," ask any member of the Institute for a copy now.

TRICKLING FILTER FLOOR INSTITUTE

Bowerston Shale Co.
Bowerston, Ohio

Industrial Materials Co.
Philadelphia 34, Pa.

Texas Vitrified Pipe Co.
Mineral Wells, Tex.

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.

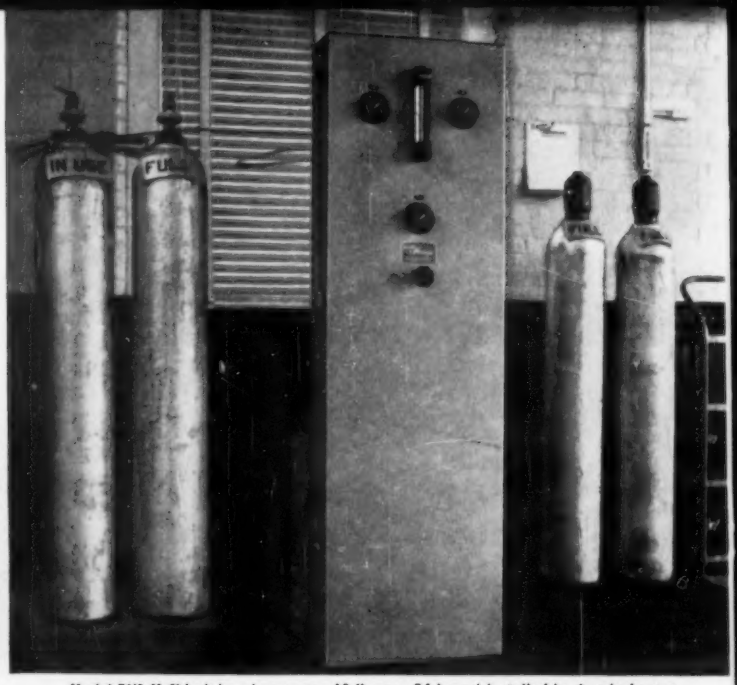
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

Natco Corporation
Pittsburgh 22, Pa.

Pomona Terra-Cotta Co.
Pomona, N. C.

For more details circle No. 20 on the Readers Service Card

Snow Pumping Station of Pennichuck Water Works built in 1893 and converted from steam to Diesel and electric in 1934.



Model DVS-M Chlorinizer (max. cap. 40 lbs. per 24 hours) installed in chemical room of Pennichuck plant. Notice easy-to-read Sightflo Indicator above control knob.

CHLORINIZER AT WORK at the Pennichuck Water Works, Nashua, N. H.

When replacement chlorination equipment was needed at the Pennichuck Water Works, Sup't. Donald C. Calderwood picked BUILDERS Visible Flow CHLORINIZER. One of the important reasons for choosing Chlorinizer was its complete freedom from chlorine hydrate troubles. By eliminating the nuisance, expense, and maintenance of bell jar heaters during the cold water season, Builders Chlorinizer has made a big hit with the plant personnel.

The Chlorinizer was installed and placed in operation entirely by Mr. Calderwood and his staff in January 1953 and, since then, absolutely no service or maintenance have been required. The chlorine feed rate, manually adjustable by the knob on the front of the feeder, plus the Sightflo Indicator have permitted fine-line control of chlorine feed to match the treatment load and the seasonal variations in raw water. A check with the plant personnel also reveals they are surprised at the odor-free operation of Builders Chlorinizer.

Yes, the trend is to Chlorinizer . . . for replacement, for plant expansion, for new projects. Bulletins 840-F1B, 840-J30 and 840-J8 give complete information. **Write Builders-Providence, Inc. (Division of B-I-F Industries, Inc.), 356 Harris Ave., Providence 1, R. I.**

SUP'T. CALDERWOOD SAYS:

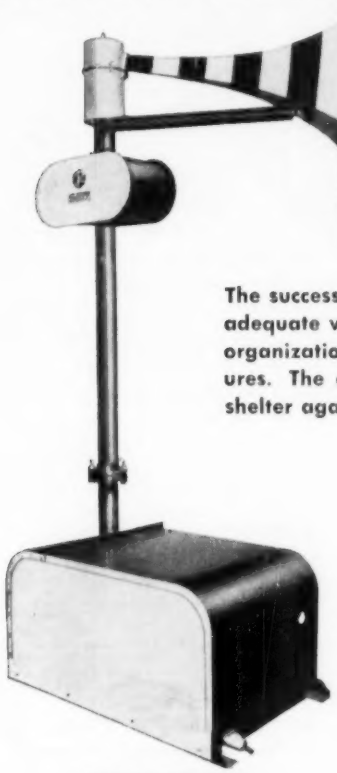
"Here in New England we have cold water conditions a good part of the year. With Builders Chlorinizer, we can now forget about chlorine hydrate troubles. All metering and controlling functions are completed before the chlorine comes in contact with any moisture whatsoever. No more tray water heaters, no more chlorination uncertainties during the Winter months."

BUILDERS-PROVIDENCE

PIONEERS IN METERS AND CONTROLS

Operation: "PEACETIME DEFENSE"

Fortunately, no American city has been put to the test for which CIVILIAN DEFENSE was originally organized. However, natural disasters in the shape of tornadoes, fires, earthquakes and explosions have put the CD organizations to the test and proved its worth in lives saved and panic prevented.



FEDERAL THUNDERBOLT directional beam siren

The success of these operations has been due to fast, adequate warning; FEDERAL SIRENS have alerted CD organizations to prompt action and preventive measures. The citizen has been warned in time to take shelter against the impending cataclysm.

Whether or not you fear the super bomb or the ravages of an enemy, no one in any part of the country is free from potential natural disaster. Money spent for an adequate CD warning system is not wasted in a gamble on the possibility of enemy activity; it is an investment for future years in additional permanent safety for your fellow citizens and coming generations. Just as the public water systems, fire alarm systems, street lighting systems and other public services established years ago have been developed for our present and future benefit, just so should an ample warning system be an essential part of community welfare and safety *today*. The vital heart of this system is the mighty FEDERAL THUNDERBOLT siren, result of over 50 years of superior engineering experience. Before you consider any siren, you owe it to your community to investigate Federal's complete line of warning signals. Write now for free information and literature.

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NEW LISTINGS

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Design Data on Steel Sheeting Headwalls

268. An engineering data sheet showing the application of Armco Interlocking Type steel sheeting for headwalls of corrugated metal drainage structures is available from Armco Drainage and Metal Products, Inc., Middletown, Ohio. Suggested headwall designs and installation notes are included. Get a copy by checking the coupon.

Photoelectric Controls Give Light when Light is Needed

269. Special advantages are apparent in the use of photoelectric controls for street lighting facilities in outlying districts not served by series circuits. You will find technical data and applications of the type P photoelectric control detailed in two new bulletins, GEC-1210 and GEA-5141B, issued by General Electric Co., Schenectady 5, N. Y. Check the coupon.

Engineering Data on the Permutit Precipitator

270. A well illustrated 20-page booklet, Bulletin 2204B, describing the many applications, principles of operation, design features, advantages, flow diagrams and specifications of the Permutit Precipitator in its three basic designs has been released by The Permutit Co., 330 West 42nd St., New York 36, N. Y. Full data is provided to determine the size and type of unit best suited for every water treatment purpose. For copies write to the manufacturer or use the coupon.

Structural Details of Concrete Bridge Design

279. A 48-page booklet entitled "Concrete Bridge Details", available from the Portland Cement Association, 33 West Grand Ave., Chicago 22, Ill., focuses attention on structural design details where improvement is most often needed. Generously illustrated, this booklet shows design features of abutment footings, breatwalls, wingwalls and bridge seats; joints for abutments and decks; and many other elements in bridge construction. Check the coupon for a copy.

Get Data on the Tractair, A "10 in 1" Machine

319. You will hold down your investment in special equipment and be ready to do 10 basic jobs on maintenance and new construction when you own a Le Roi "Tractair", the versatile combination of a 35-hp wheel tractor and 105 cfm air compressor. Be sure to investigate the unlimited usefulness of this machine. Get full data from the Le Roi Co., Milwaukee 14, Wis., or check the coupon.

Technical Bulletin on Solenoid Operated Valves

288. Full technical data on applications, construction, dimensions and specifications of Golden-Anderson Cushioned solenoid operated valves is contained in Bulletin W-7, available from Golden-Anderson Valve Specialty Co., 207 Keenan Bldg., Pittsburgh 22, Pa. Selected valve patterns are offered in ½ to 2-in. and 2½ to 36-in. sizes. Get all the details; just check the coupon.

Chemicals Used in Water, Waste and Sewage Treatment

276. A new chart giving information on the form, weight, solubility, strength and use of common water, sewage and waste treatment chemicals is available from Wallace & Tiernan, Newark 1, N. J. Data on materials suitable for handling each chemical in either its dry or solution form are included. Check the coupon today.

Submersible Sewage Ejector Simplifies Installation

275. The Weil submersible non-clog sewage ejector is a compact unit with a completely sealed motor, available in several sizes with capacities up to 300 gpm. For details on unit selection, installation methods, construction features and controls get Bulletin SE-860A from Weil Pump Co., 1530 No. Fremont St., Chicago 22, Ill. Check the coupon.

Permanent Traffic Markings With "Perma-Line"

300. Traffic markings for center lines, crosswalks and other uses may be installed permanently by the use of "Perma-Line", a plasticized filler which, after curing, becomes an integral part of the road itself. For more data on the process and reports of public works officials and testing laboratories, write to Perma-Line Corp. of U. S., 10 West 47th St., New York 19, N. Y., or check the coupon.

New Advantages In Boiler Construction

309. Get the latest data on cost-saving tube-supported wall enclosures for large and small boilers from Bigelow-Liptak Corp., 2550 W. Grand Ave., Detroit 8, Mich. 12-page booklet gives full details. Check the coupon today.

Engineering Data on Diatomite Filters

320. Information on diatomite filters, including construction details, specifications, auxiliary equipment, operating costs and diagrams of a typical swimming pool installation are included in Bulletin No. 5365, issued by General Filter Co., Ames, Iowa. Get your copy by checking the coupon.

Information on Snow Melting Systems

321. A colorful and informative booklet about steel pipe snow melting and ice removal systems, prepared by the American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y., answers the most commonly asked questions on snow melting and furnishes detailed design and installation data. Check the coupon for your copy.

Get Tough Blades and Cutting Edges For Your Construction Equipment

326. Controlled analysis steels used in Shunk blades and cutting edges for graders, scrapers, dozers, and snow plows means long life and wear resistance to give you more value from your maintenance dollar. Full data for ordering blades and scarifier teeth for standard and special equipment is available from Shunk Mfg. Co., Bucyrus, Ohio. Check the coupon today.

Get New Data on Garbage Cookers for Hog Feed

287. Data on two types of garbage cooking equipment is now available from Littleford Bros., Inc., 457 E. Pearl St., Cincinnati 2, Ohio. Steam generators, both portable and stationary, are described in Bulletin MP-51; oil fired cooking kettles with special agitator and large discharge door, trailer or skid mounted is covered in Bulletin MP-50. Check the coupon now.

1-54

USE THIS COUPON to get detailed information on products and materials mentioned in this issue. Circle numbers below and mail today.

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305 306 307 309 312 313 315 316 317 319
320 321 322 324 326 327 332 335 336 337
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CLEVELAND TRENCHERS

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HIGHWAY WIDENING

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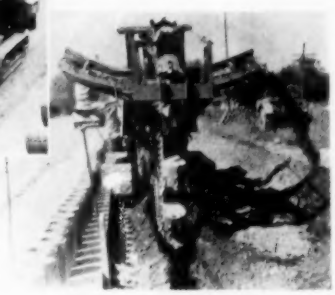


DRAINAGE TRENCHING

Highway Widening

Proved superior performance in highway widening and highway improvement work has brought about a widespread and ever-increasing use of Cleveland Trenchers in projects of this type. Here are just a few of the many underlying reasons for Cleveland's outstanding popularity in this field.

1. Clevelands complete the cut in one pass . . . help you keep all phases of a widening job close together, not strung out along the highway.

2. Clevelands cut clean, accurately, right to grade . . . make every cut a real precision job.

3. Clevelands cut fast . . . real mechanical efficiency, not brute force, for speed even on the tough jobs.

4. Clevelands truck load easily . . . no additional equipment or men are needed when spoil haul is required.

5. Clevelands are *versatile* . . . cut your tile trenches—dig *all* kinds of trench—give you high production at low cost—with minimum of service and repairs—day after day—year after year.

GET THE FULL **CLEVELAND** *STORY FROM YOUR LOCAL DISTRIBUTOR*

THE CLEVELAND TRENCHER CO.

Pioneer of the Modern Trencher

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

Now's the time to mail this month's Reader's Service card.

To order these helpful booklets check the coupon on page 28.

NEW LISTINGS (cont.)

Convenient Data on Water Works Fittings

327. Complete data on water works brass goods and allied fittings, including curb stops, corporation stops and couplings, lead gooseknecks, meter fittings, service boxes and drilling and tapping machines is furnished in convenient form by Hays Mfg. Co., Erie, Pa. Be sure you have this information in your files. Check the coupon.

Cut the Cost of Road Rehabilitation

332. Be sure to investigate the Hetherington & Berner "Moto-Paver," the machine that does a complete mixing and laying job in one continuous operation. Specifications and complete information on both standard and heavy-duty models is provided in Bulletin MP-51. Get your copy from Hetherington & Berner, Inc., Indianapolis, Ind., or check the coupon.

Reduce Labor Costs With Power Sewer Cleaners

353. A complete line of sewer cleaning equipment, including labor saving power units and all types of buckets, cables, rods and flushing equipment are listed in Catalog 10 of the Turbine Sewer Machine Co., Division of Chas. H. Stehling Co., 1303 N. Fourth St., Milwaukee 12, Wis. Check the coupon for your copy.

Chemical Feed Pump For Chlorinating and Fluoridation

322. For complete data on a heavy duty, positive displacement, diaphragm type pump for accurate feeding, chlorinating and fluoridation solutions, get Bulletin PM 20 issued by Precision Machine Co., 5 Union Sq., Somerville 43, Mass. Use the coupon today.

Helpful Data on Distributors For Bituminous Materials

324. Two models of pressure distributors featuring uniform pressure and temperature, accurate displacement pumping are covered in bulletins available from Standard Steel Works, Dept. PW, North Kansas City, Mo. Check coupon for copies.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 310 E. 45th St., New York 17, N. Y. Check the coupon and we will forward your request.

Packaged Sewage Treatment— Just Right for Small Places

36. "Packaged" Sewage Treatment Plants specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 622 Diversey Pkwy., Chicago 14, Ill.

For Prompt Service Use The Coupon

What You Should Know About Rotary Distributors

199. An authoritative discussion of distributors for low and high rate filtration at municipal and industrial waste treatment plants has been presented in a 20-page booklet by the Dorr Co., Engineers, Barry Pl., Stamford, Conn. Unit sizes range from 20 to 200 ft. diameter and capacities from 60 to 22,000 gpm. Trickling filter processes and applications, design features, hydraulic and mechanical factors and other related material are covered fully in this helpful booklet. Check the coupon for your copy.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete, easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 40-page booklet issued by Flexible Sales Corp., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the coupon for your copy of this helpful handbook.

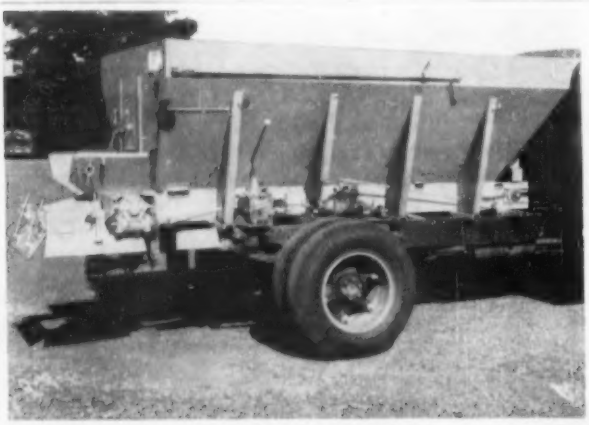
Helpful Design Data For Sewage Ejectors

81. The applications and advantages of pneumatic sewage ejectors are outlined in a new bulletin of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems. Get your copy by checking coupon.

Complete Catalog for Engineers Shows Water and Sewage Plant Equipment

191. The complete line of Jeffrey equipment for treatment of water, sewage and industrial wastes is covered in 52-page Catalog 833. Detailed information is provided on bar screens, grinders, grit collectors, "Jigrit" washers, sludge collectors, feeders, conveyors this valuable booklet. Use coupon or write and other related units. Photos and drawings of installations plus capacity tables complete Jeffrey Mfg. Co., 947 N. 4th St., Columbus 16, Ohio.

(Continued on page 34)



BURCH UNI-FLOW SPREADER

for Salt, Sand, Cinders, Chips, etc.

Permits efficient, economical elimination of ice hazards. Operation direct from truck power take-off. Easily adjustable spreading baffles. Fully enclosed spinner reduction gear and multiple plate clutch (cab controlled). Standard sizes 5 and 9 cu. yd. Designed for easy and proper mounting on standard motor truck chassis. Spinner unit can easily be removed and hopper used for hauling miscellaneous materials. Write Dept. P-14 for literature today.

BURCH is the BEST BUY!

BURCH-BUILT ROSS SNOW PLOW

Sno-Flo design eliminates side draft and offers least resistance in compact snow. Snow is lifted, rolled, and ejected in a continuous flow. Renewable reinforcing plate provides rugged strength where most needed. Tough, high-carbon steel cutting edges fastened directly to reinforcing plate give an extra-rugged assembly. Write for literature today.

The BURCH Corporation

CRESTLINE, OHIO, U.S.A.

MANUFACTURERS OF EQUIPMENT FOR CONSTRUCTION AND MAINTENANCE OF ROADS AND STREETS

Get full details of this month's products . . . mail your Readers' Service card today.

A. W. Grathwol, manager of the Sandusky, Ohio, Water Distribution Department, checking static water pressure on a newly installed Darling B-50-B hydrant.

Word is getting around about DARLING'S NEW B-50-B FIRE HYDRANT

WATER distribution men like A. W. Grathwol of the Sandusky, Ohio, Water Distribution Department, are spreading the good news about the new patented Darling B-50-B fire hydrant. It rates as the most important fire hydrant advance in 50 years.

Here are reasons why . . .

1. The "O" ring seals eliminate need for a stuffing box. Darling's B-50-B is a packless, *dry-top* hydrant that saves service time and trouble. It does away with bothersome packing gland adjustment and maintenance, assures constant lubrication of the operating threads *and prevents water from reaching the operating threads.*

2. The Darling B-50-B is a *ball-bearing* operated hydrant. Opening and closing takes less than half the usual wrench torque.

And you also get another long-time advantage of Darling hydrants . . . all inside working parts, including the main valve seat and drain valve seats, can be removed through the top *by one man* for on-the-spot inspection and maintenance. Write for Bulletin No. 5007 before you decide on any hydrant. Address . . .

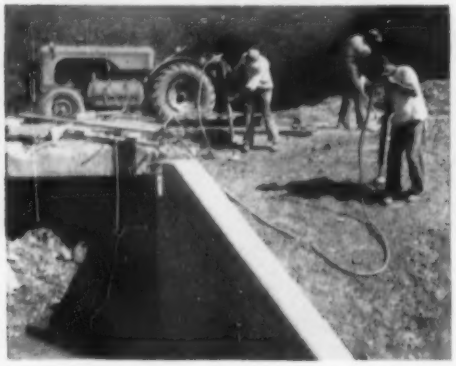
DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario

Need more facts about advertised products? Mail your Readers' Service card now.

Tamping — Here's a Le Roi-CLEVELAND back-fill tamper air-powered by Tractair, that gives you faster, easier tamping, better compaction, lower costs. This example shows how Tractair teams up with Le Roi-CLEVELAND Air Tools to save time, work, money.



Cutting asphalt pavement — with a Tractair-powered Le Roi-CLEVELAND paving breaker. Note, Tractair in background is equipped with a sweeping attachment. This is just another of many ways that Tractair can save you money.

Drilling trench — Easy holding Le Roi-CLEVELAND sinkers provide the fastest way of drilling rock. The air-power source is a Tractair, equipped with a front-end loader. Tractair is extremely mobile. It has a low center of gravity. It takes money-saving air power anywhere.

LE ROI TRACTAIR

...the 10 in 1 machine that does 10 basic jobs to save you money

It holds down your investment in special equipment

Because Tractair is a combination 35-hp wheel tractor and 105-cfm air compressor, it is extremely versatile.

It lets you take air power wherever you want it — air power for drilling rock, tamping fill, breaking concrete, driving spikes and form pins, or pumping water.

When it is equipped with attachments, you get added usefulness. You can load, back-fill, dig, sweep or hoist.

Although Tractair was pioneered and developed by Le Roi Company to do 10 basic jobs, its money-saving usefulness on costly, nuisance-type work is limited only by the user's imagination.

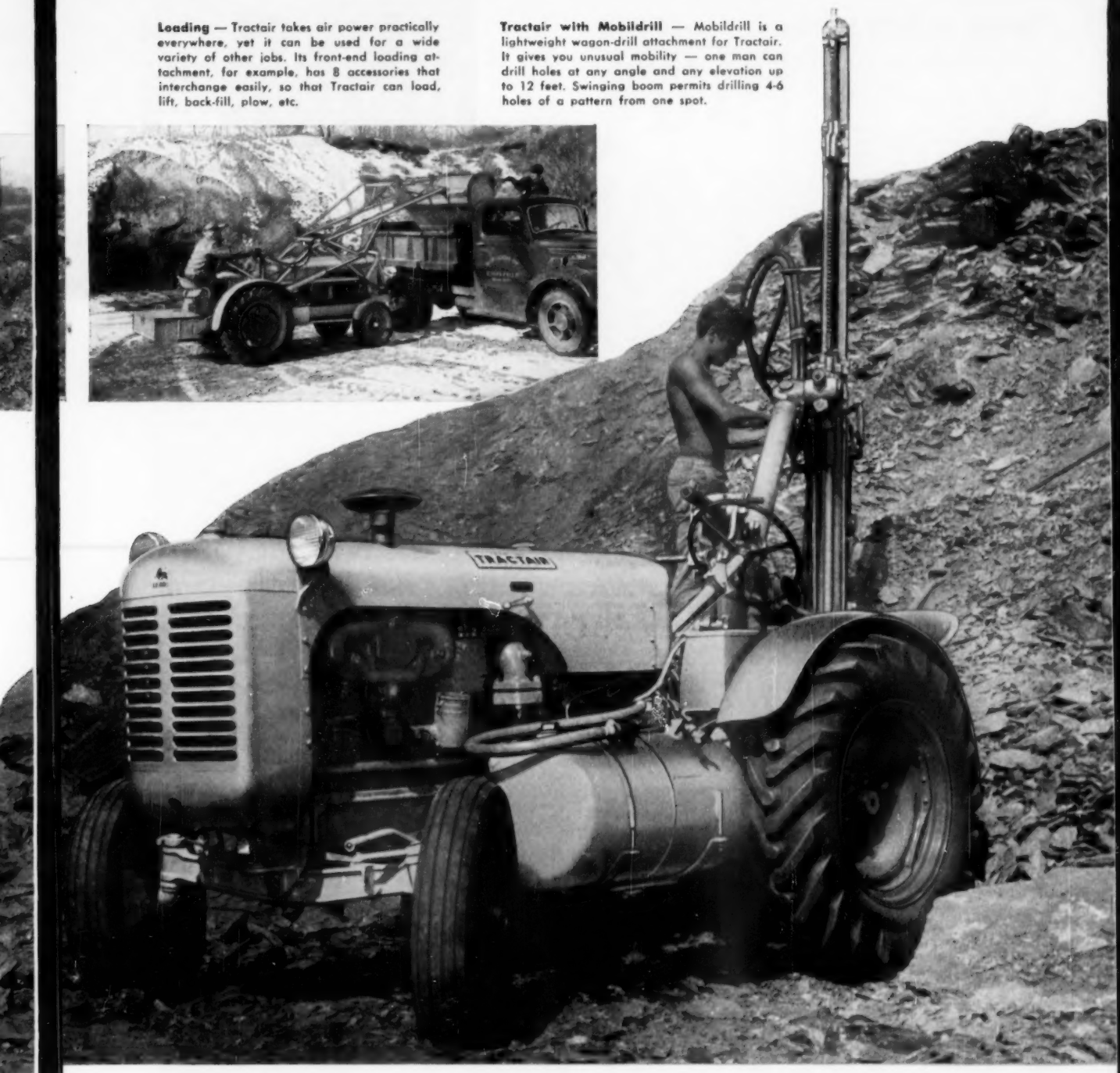
If you want to cut costs, get Tractair. Call your Le Roi dealer for a demonstration, or write us for further information.

LE ROI GIVES YOU MORE FOR YOUR MONEY

More Utility!
More Profits!

Loading — Tractair takes air power practically everywhere, yet it can be used for a wide variety of other jobs. Its front-end loading attachment, for example, has 8 accessories that interchange easily, so that Tractair can load, lift, back-fill, plow, etc.

Tractair with Mobildrill — Mobildrill is a lightweight wagon-drill attachment for Tractair. It gives you unusual mobility — one man can drill holes at any angle and any elevation up to 12 feet. Swinging boom permits drilling 4-6 holes of a pattern from one spot.



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T-31

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To order these helpful booklets check the coupon on page 28.

SEWERAGE AND WASTE TREATMENT

(*Continued from page 30*)

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet must be made on business letterhead.

Useful Data on Butterfly Valves

100. Complete descriptions and tables of dimensions on the full line of Rockwell Butterfly Valves is contained in several bulletins published by the company. Construction details and special control features are illustrated. Write W. S. Rockwell Co., Eliot Street, Fairfield, Conn.

End Roof Problems With Root-Proof Sewers

107. Troubles caused by roots and corrosions in house connections can be eliminated by the use of root-proof Bermico sewer pipe. Full details on this smooth, waterproof, tight-sealing pipe available by checking the coupon, or write to the Brown Co., Dept. PW, 150 Causeway St., Boston 14, Mass.

Helpful Data on Venturi Type Meters

221. The Simplex type MO Meter for measurement of water, sewage, sludge and industrial liquor flows over wide ranges, is featured in an information-packed bulletin, No. 500, issued by Simplex Valve & Meter Co., Philadelphia 42, Pa. Get this bulletin for data on operation, construction, accuracy, primary devices and other information of interest to engineers who deal with fluid flow problems. Check the coupon.

Design Data for the Spiraflo Clarifier

124. Be sure to investigate the advantages of the Spiraflo clarifier for sewage treatment. Full engineering data, description of the unit, test results and specifications are offered in 24-page Bulletin 122 by Lakeside Engineering Corp., 222 W. Adams St., Chicago, Ill. Check the coupon today.

Helpful Data on Sluice Gates

138. In a well-organized 48-page catalog you will find complete engineering and design data on Pekrul sluice gates, headgates, automatic flap gates, lifts and accessories. Numerous models in 6" to 92" sizes are available, and all pertinent data will be found in this helpful booklet. Write Morse Bros. Machinery Co. Denver, Colo., or use the coupon.

Design Data for Insulated Piping

188. For all jobs where insulated piping is required you will want full design data on Rie-wiL Prefabricated Insulated Piping. Get 28-page catalog from the Rie-wiL Co., Barberton, Ohio, for details on both underground and overhead lines.

How to Compute Quantities of Jointing Materials

271. A helpful table for determining quantities of "Tegul-Mineralead" required, using jute or "Hyde-Ro Rings", plus complete answers to your questions on sulfur compound jointing materials will be found in Bulletin M-10 issued by Atlas Mineral Products Co., Mertztown, Pa. Check the handy coupon today.

Reference Book on Lubricated Plug Valves

273. Lubricated plug valves, including stick-proof lever sealed valves for easy operation and positive mechanical seal are fully described in reference books issued by Homestead Valve Mfg. Co., Box 550, Coraopolis, Pa. Check the coupon for your copy.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled, permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the coupon for free copy.

Data Offered On Mixed Flow Pumps

201. Data on the complete line of Worthington Mixflo pumps of the two-vane, non-clogging sewage type is offered in 16-page bulletin W-317-H16. Salient features are outlined, typical sections, performance curves and general data for five types are included. Helpful charts aid shafting selection. Copies available by using coupon or from Worthington Corp., Harrison, N. J.

Data Offered on Water, Sewage and Waste Treatment Equipment

243. Equipment for sewage treatment, water purification and industrial waste treatment is described in a 16-page Book No. 2440, published by Link-Belt Co., Colmar, Pa. Case histories, photographs and schematic drawings are included. Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, flash mixers, scum breakers and other units are described. Check the coupon for your copy.

Discussion of Sewage Chlorination

316. Sewage chlorination and factors in selecting chlorine gas feeders are discussed in Keep Sheet No. 15 issued by Builders-Providence, Inc., 356 Harris Ave., Providence 1, R. I. All factors related to sewage chlorination are covered in this valuable reference leaflet. Check the coupon for your copy.

Low cost, pure filtered water, for small and medium size municipal water works now possible with a —

SPARKLER Model SCJ self cleaning water filter

The model SCJ filter is a diatomite slurry feed filter designed to produce the highest quality pure water at a maintenance cost much lower than usually can be attained with older type filters.

This filter can be cleaned in two to five minutes either by flushing off with the built-in jet spray or by backwashing or a combination of both. The filter media is usually a synthetic cloth such as orlon which pre-coats quickly and washes clean rapidly.

A high efficiency diatomite slurry feeder, which operates in conjunction with the SCJ Sparkler Filter, adds greatly to the length of cycle between cleanings . . . resulting in lower operating costs. Operators can be easily trained . . . no highly skilled specialized personnel required. Floor space occupied by the SCJ is relatively small for the extremely large volumes handled. Single units are available in sizes to handle up to 96,000 G.P.H. . . . or over 1,000,000 gallons per day. And . . . this is important . . . the largest unit uses less than 1000 gallons of water to clean the filter.

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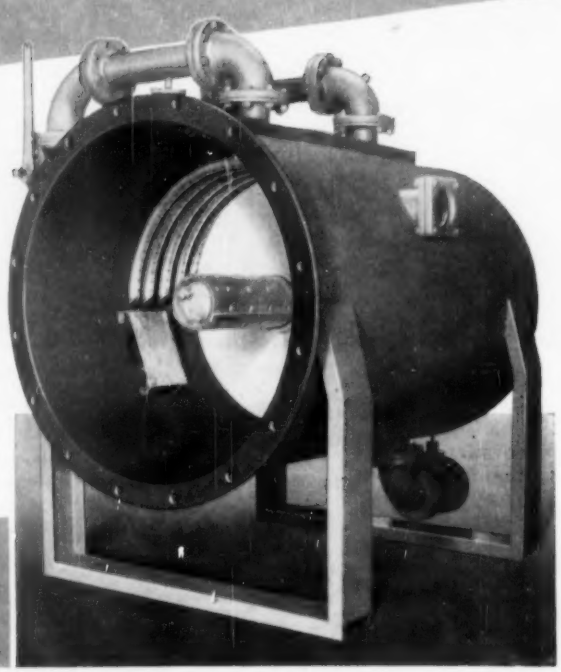

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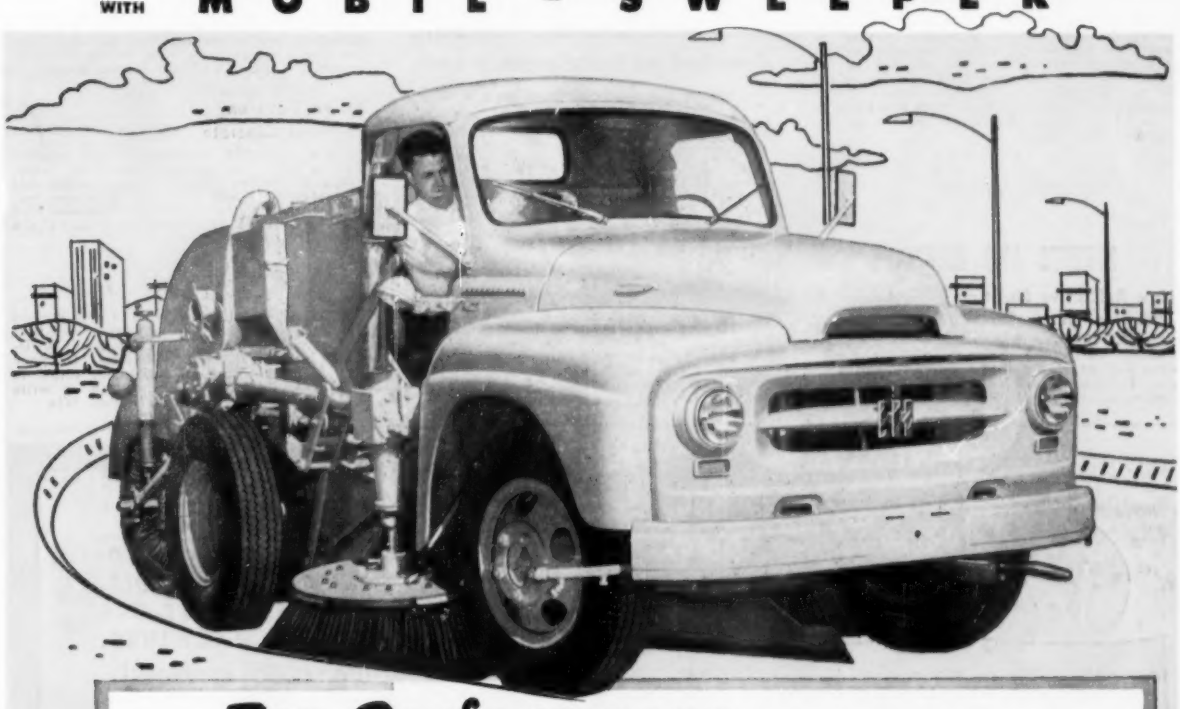
WITH **MOBIL - SWEEPER**



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Discover new ways to save money on street sweeping, airport sweeping, and highway sanitation with the big Mobil-Sweeper. Savings of 45% over all previous methods of street sanitation are being reported by Mobil-Sweeper users. Learn more about what communities across the Nation report on actual experiences with this fine sweeper. Many communities say maintenance and upkeep costs are the lowest on record. Manpower requirements are lower too.

Mobil-Sweeper can change street sanitation into a one-man job. Traveling to-and-from the dump at top traffic speeds, Mobil-Sweeper eliminates need for a truck and pick-up crew to follow. Where central dumping is used, Mobil-Sweeper's big hopper capacity makes it a top performer in this system.

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Write for literature today!

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DIVISION OF THE CONVEYOR CO. 3260 E. Slauson Ave. • Los Angeles 58, Calif.

To order these helpful booklets check the coupon on page 28.

Efficient Blowers for Activated Sludge Plants

232. Many advantages of Roots-Connersville positive displacement rotary blowers are described in Bulletin 22-23-B-13, which also provides characteristic curves for operation with constant speed, multi-speed and variable speed motors and details of several types of blowers. Get this helpful bulletin by checking the coupon. Roots-Connersville Blower Corp., Connersville, Ind.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy coupon or write Combustion Engineering Inc., Flash Dryer Div., 200 Madison Ave., New York 16, N. Y.

Instrumentation and Control Equipment For Water and Sewage Plants

298. Full engineering data on the instrumentation and control equipment needed in water works, sewage plants, pumping station and related installations are provided in the "Application Engineering Data" binder issued by the Foxboro Co., Foxboro, Mass. Every engineer and designer should have this valuable material on hand. Check the coupon if you can use this data.

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STREETS AND HIGHWAYS

How Reflective Sheeting Improves Traffic Signs

157. Get full data on Grotelite reflective sheeting for smooth, brilliant, long-life traffic signs and marking devices from the Grote Mfg. Co., Bellevue, Ky. Use the handy card or coupon today.

Faster Compaction On Street Repairs

108. Holes and trenches cut through pavement present difficult areas for compaction of backfill. Learn how to do the job quickly, easily and cheaply by using the self-contained, portable Barco Rammer. Full data on this low cost will be found in Bulletin 621. Write Barco Mfg. Co., 500 No. Hough St., Barrington, Ill., or check the coupon.

Cut Resurfacing Costs With Manhole Adapters

137. There is a WB "Manhole Adapter" to fit every street opening and for varying elevations to suit your resurfacing job. Be sure to check this way to maintain structural strength, reduce traffic interference and save time and labor. Get full data from WB "Manhole Adapter", 1320 McGee St., Kansas City 6, Mo. Check the coupon.

The Manufacturers' literature described on these pages is costly, so order just what you need. Use the handy mailing card or coupon today.

How To Build Stabilized Heavy Traffic Pavements

233. A 16-page booklet published by Seaman Motors, Inc., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check coupon for copy.

How to Save Time on Curb and Gutter Work

143. Every type of curb and gutter work is illustrated in the 12-page Heltzel catalog on steel forms for building concrete curbs, gutters and sidewalks. Time-saving setups show how to speed up the job and save money. Get your copy from Heltzel Steel Form & Iron Co., Dept. PW, Warren, Ohio.

Black-Top Paver Offers Many Advantages

150. The flexible Adnun Black Top Paver lays any asphalt mix, hot or cold, in widths from 6 ft. to 13 ft. Careful design lowers operating cost and cuts maintenance. Attachments spread stone, cinders or slag. Get full data on this machine by checking coupon. The Foute Co., 1954 State St., Nunda, N. Y.

Speed Concrete Removal And Make Better Patches

202. Felker self-propelled concrete cutters saw to 6½" depths to facilitate concrete removal and produce smooth, straight edges which resist spalling when patched. Full data on cutters and segmented type diamond abrasive wheels are available from Felker Mfg. Co., Torrance, Calif. Check the coupon today.

Design Data on Universal Concrete Cribbing

274. Complete information on concrete cribbing for embankment retaining walls, bridge abutments, highway underpasses and other structures will be found in a new bulletin issued by the Universal Concrete Pipe Co., 297 S. High St., Columbus, Ohio. Check coupon for free copy.

Trucks for Long Municipal Service

336. The Oshkosh line of 4 and 6-wheel drive trucks, built to give long, dependable service in and off the highway work is described in several handsome bulletins. Get your copies now to check the model best suited to your needs. Us the handy coupon or write Oshkosh Motor Truck, Inc., Oshkosh, Wis.

CUTS MORE CONCRETE PER DAY BECAUSE THE MODEL 252 IS SELF-PROPELLED! OVERCOMES OPERATOR FATIGUE, ELIMINATES FREQUENT REST PERIODS, COVERS FAR MORE FOOTAGE IN A DAY!

★ **LONGER BLADE LIFE**—No sudden bumps and jolts to add unnecessary wear and tear on the diamond wheel. Smooth, uniform POWER FEED adds longer blade life—CUTS COSTS! Actual field reports have shown blade life as much as doubled.

★ **DEEP CUTS**—approximately 7" maximum with 18" blade. 13.5 h.p. engine furnishes power to spare.

★ **DOUBLE END SPINDLE** for right or left hand cutting.

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Ask your Felker DI-MET Representative for recommendations.

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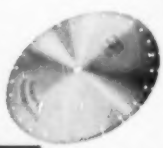
Use DI-MET Machines and Blades for every concrete cutting requirement!

Here's an unusual application—sawing up and re-locating a concrete wall! Savings: $241.00 on a $991.00 job!



Felker DI-MET the SEGMENTED type diamond blade with peak performance! Built by the only manufacturer making both concrete cutters and diamond wheels. Bond variations for every cutting requirement insure more footage—lower cost per cut!

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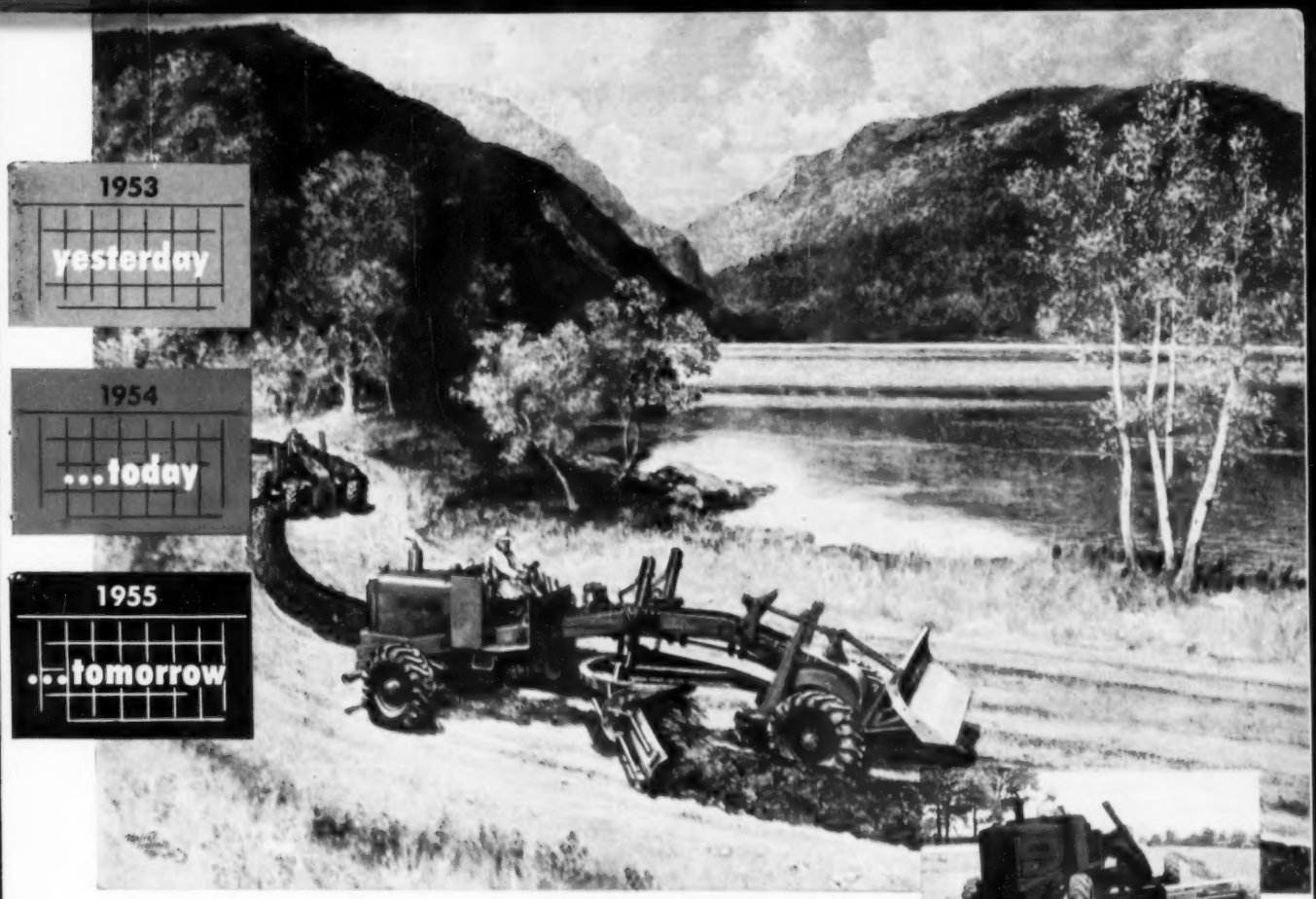

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you've got to swing that rear-end...

for TOP performance

On jobs like these *(and dozens more)*—that unbeatable combination, all-wheel drive and all-wheel steer* does more and better work in less time and at lower costs!

*For the 17th Consecutive Year—Only Austin-Western has it.

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To order these helpful booklets check the coupon on page 28.

8 Reasons Why You Should Check the Jaeger Loader

207. In a profusely illustrated 16-page catalog devoted to the applications and special design features of the Jaeger "Load-Plus" tractor-loader unit, eight good reasons listed to back up the claim that this machine outproduces any other loader of its size. These include load capacity, balance, reach, maneuverability, automatic power adjustment by torque converter, instant reversal, multiple speed and ease of control. Check them all by getting a copy of Catalog L100-3. Check the coupon today. Jaeger Machine Co., 400 Dublin Ave., Columbus 15, Ohio.

Heating, Thawing and Melting With Hauck Burner Equipment

277. A helpful 16-page bulletin covers the complete line of Hauck heating and melting equipment. Data covers units for every water, sewer and street department purpose, from "one-man" burners to large size portable kettles. For a useful addition to your reference file, get Bulletin 1068 from Hauck Mfg. Co., 117-127 Tenth St., Brooklyn 15, N. Y.

Use Hot Patch Material On All Maintenance Jobs

297. With the Barber-Greene Mixall you can get hot patch material wherever and whenever you need it for all maintenance jobs. Send for new 8-page bulletin that gives full information on this small, highly portable unit that turns out all types of bituminous patch material in any quantity you need. Write Barber-Greene Co., Aurora, Ill., or use the coupon.

Municipalities Make Equipment Dollars Go Further

55. Be sure to get your copy of "Saving Facts", an illustrated booklet prepared by The Oliver Corp. that shows how equipment dollars can be stretched on mnuicipal work. Text and photos describe the application of tractors and money-saving attachments in street maintenance, snow removal, waste disposal, pipe laying and other projects. Write The Oliver Corp., Industrial Div., 400 W. Madison, Chicago, Ill. or check coupon.

Blades For All Types Of Equipment

60. Get information now on long-wearing blades for graders, scrapers, bulldozers, snow plows and scoops; snow plow noses and runners; scarifier teeth and numerous other products for road machinery. Check coupon or write to Paper-Calmenson & Co., St Paul 8, Minn.

Booklet Helps Design of Custom-Engineered Steel Buildings

110. Custom-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful 32-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Use the coupon or write to Butler Mfg. Co., Kansas City, Mo.

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the coupon today.

The Loader That Digs Like a Power Shovel

317. The power crowder-arm of the Lessmann loader gives you power shovel advantages in this tractor-mounted unit, and enables you to fill the bucket in tough digging without spinning the wheels. Check the coupon for all the details on this rugged, heavy-duty unit. Lessmann Mfg. Co., Des Moines 4, Iowa.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the coupon today.

Surveying Instruments— Basic Tools for the Engineer

228. Be sure you get Bulletin 1052 of David White Co. when you need transits, levels and other top quality surveyors gear. A full line of surveying instruments and accessories is described in their 42-page catalog. Get your copy by checking the coupon or write to David White Co., 315 W. Court St., Milwaukee 12, Wis.

Choosing Trucks For Municipal Service

264. For all municipal services, trucks are needed that are high in efficiency and economy. Be sure to investigate the White 3000, engineered for high performance. Full details on White Super Power trucks from the White Motor Company, Cleveland 1, Ohio.

Make a careful check of the catalog reviews listed on these pages, then send the reply card to our Readers' Service Department. You'll like this convenient way to get up-to-date information.

How the Mobil-Sweeper Can Improve Street Sweeping

305. Sweeping costs can be cut with the Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to The Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use coupon for complete details on this machine.

Easier Street Sweeping With Wilshire Municipal Sweepers

306. A handy chart included in a comprehensive 20-page bulletin enables you to check your street sweeping costs against the man-hour savings of all Wilshire power sweeper models. Other helpful information shows all details on sweepers for large and small communities. Get this illustrated bulletin by writing Wilshire Power Sweeper Co., Glendale 4, Calif., or check the coupon.

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CONSTRUCTION EQUIPMENT AND MATERIALS

What's Your Digging Problem? Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 10 feet behind tractor in 140° arc and to depth of 8 feet. For full details check the coupon. Sherman Products, Inc., Royal Oak, Mich.

1,001 Profitable Uses For Holmes-Owen Loader

39. The addition of a Holmes-Owen Loader to your dump truck converts it into a complete digging and loading unit that enables one man to load, haul and dump. Illustrated folder shows how this self-loading unit with hydraulic crowding action can be a real time and labor saver for the municipality or contractor. Check the handy coupon for full data. Ernest Holmes Co., Chattanooga, Tenn.

Concrete Saw Cuts Smooth, Straight Edges

85. When the sides of patches and trenches are sawed before breaking, a saving of 25% in removal costs is claimed. And the smooth, straight edges won't spall or crack after replacement material is poured. Investigate the exclusive features that give maximum economy to Clipper concrete saws. Full information from Clipper Mfg. Co., 2823 S. Warwick, Kansas City 8, Mo., or check the handy coupon.

Be Sure to Check Your Tractor Shovel Needs

94. A comprehensive 16-page catalog now available from Frank G. Hough Co., 761 Seventh St., Libertyville, Ill., shows how cities, counties, contractors and others use the Model HR four-wheel drive Payloader on earth and material handling jobs. Be sure to check the ways you could use this machine. Get Form No. 225 by checking the coupon.

Details on Motor Grader Construction and Use

312. In a handsome catalog, profusely illustrated with diagrams and photographs of unusually fine quality, the Galion Iron Works and Mfg. Co., Galion, Ohio, has presented all details on the construction and operating features of their Model 118 motor grader. This impressive 28-page catalog, No. 375, is available without charge. Just check the coupon.

Trencher Fits Municipal Needs

315. A bulletin describing the Cleveland Model 95 trencher has been published by the Cleveland Trencher Co., Cleveland 17, Ohio. The Model 95, called "The standard machine for city and suburban work", is versatile, manueverable and economical for use on water lines, service lines, road widening and all utilities trenching. Get this 8-page illustrated bulletin by checking the coupon.

Versatile Maintainer Has Year 'Round Usefulness

131. The sturdy Huber Maintainer will work for you the year 'round on mainteance jobs, berm leveling, road planning, bull-dozing, snow plowing, brooming, mowing shoulders and as a patch roller. Good ideas on how to do all these jobs in Bulletin No. M-138. Write Huber Manufacturing Co., Dept. PW, Marion, Ohio.

SNOW AND ICE CONTROL

Uniform Salt and Cinder Spreading at All Speeds

93. Be sure to investigate the hydraulically operated ground drive offered by Baughman to give you the advantages of two drive speeds and uniform distribution of material regardless of truck speed, but without the need for power takeoff or transmission. Full data on this and many other features in Form A-380. Baughman Mfg. Co., Jerseyville, Ill.

Snow Plows for Every Street and Highway Need

335. For details on the full line of Frink Sno-Plows, including the new taper-type reversible plow with hydraulic roll-over control, reversible trip-blade plows, Vee plows and all accessories, check the coupon today. Frink Sno-Plows, Inc., Clayton, N. Y.

Uniform Salt Spreading Saves Material

145. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on this spreader and table of material application rates. Use coupon or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

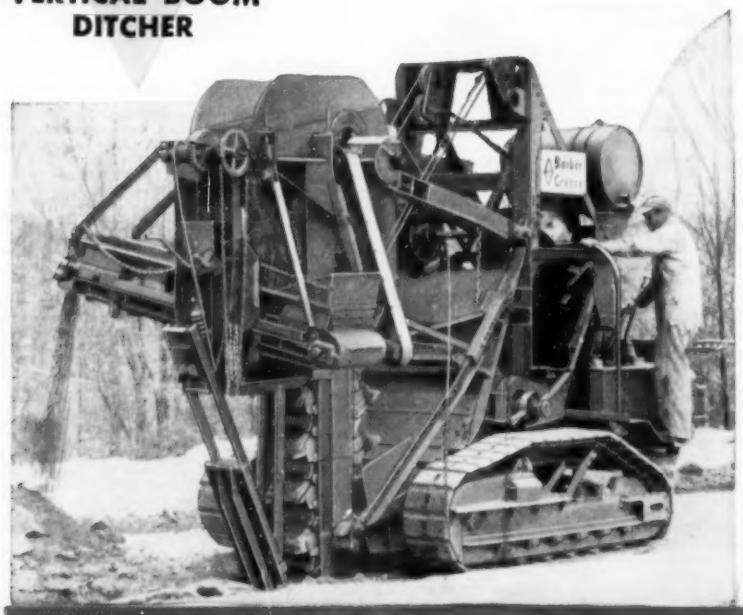
How Motor Graders Beat the Snow Problem

307. The power and directional control of Austin-Western Four-Wheel Drive, Four-Wheel Steer Power Graders are a combination that beats the toughest plowing combination. Get data on plow and snow loader attachments for graders from Austin-Western Co., Aurora, Ill. Check the coupon.

BARBER-GREENE HEAVY DUTY DITCHER

MODEL 44-C VERTICAL BOOM DITCHER

for lowest cost per foot of trench in all weather



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DIGS CLEAN... leaves vertical walls . . . square cuts . . . eliminates most expensive handwork.

MILLING ACTION... closely spaced buckets pare small increments as a milling machine cuts metal.

OVERLOAD RELEASE... slips when overload occurs . . . automatically re-sets itself . . . no down time for replacing shear bolts, etc.

Only Barber-Greene offers so many proved ditcher advantages to save time and money on all trenching operations. For instance, the Vertical Boom means a compact, easily maneuvered machine: digs straight down, right up to walks, foundations, underground pipes, etc. . . . digs *all* the ditch . . . no expensive handwork required. The Vertical Boom stays *down* — the harder the digging, the harder the buckets hold it down. Cuts trench to 8'-3" depth, 24" wide.

Self-cleaning "kick-out" buckets operate in a vertical plane . . . produce the famous B-G milling action that cuts through coral, frozen ground, caliche and other formations that completely stop other ditchers.

Another time- and money-saving feature is the exclusive B-G overload release that slips on overload and automatically resets itself until the obstruction is removed or the operator stops machine—and then it re-sets itself for continued operation, protecting machine, hidden mains, cables, etc.

Plan to put the advantages of the B-G Model 44-C to work for you.

Barber-Greene BG

Aurora, Illinois, U. S. A.

Now's the time to mail this month's Reader's Service card.

To order these helpful booklets check the coupon on page 28.

Keep Batteries in Peak Condition

337. No more battery troubles on slow-moving trucks and other equipment that fail to keep up the charge with conventional DC generators. The Leece-Neville AC-DC generating system is easy to install, needs minimum maintenance and supplies all the power you need. Get full details by checking the coupon. Leece-Neville Co., 5109 Hamilton St., Cleveland, Ohio.

20-Page Book Shows All Snow Plow Features

313. The full line of Ross snow plows, including one-way "Rigid" types, trip moldboard plows, Vee plows, snow wings, sidewalk plows and plow hitches, hydraulic controls, plus spreaders for ice control are featured in a profusely illustrated booklet issued by the Burch Corp., Crestline, Ohio. Be sure to get this comprehensive booklet and review your plow requirements. Check the coupon.

WATER WORKS

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6600-A, Chicago 80, Ill. Check the coupon.

Technical Data on Fluorides And Other Chemicals

48. Technical data on fluorides and other chemicals will be found in a comprehensive booklet issued by Blockson Chemical Co., Joliet, Ill. This helpful 60-page booklet includes a great deal of general information of value to water works men. Get a copy by checking the coupon.

Helpful Data on Water Works Products

49. A completely new catalog covering the entire line of water distribution and service products offered by the Mueller Company, of Decatur, Ill., is now available to engineers and water works superintendents. The 328-page catalog features an easy-to-use sectional indexing arrangement to facilitate quick reference to any of the hundreds of products listed. A large section of useful engineering information is included. Check the coupon today.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal, control of certain tastes and odors, plus other aids in high quality water production. Check coupon for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

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How Engineers and Contractors Can Get This Comprehensive Water Control Apparatus Catalog

141. A 250-page catalog showng the full scope of Rodney Hunt water control apparatus is now available for distribution to consulting engineers, contractors and others actively engaged in water control construction work. Hundreds of diagrams, detailed descriptions and specifications show all types of sluice gates and related items, and a special section provides helpful engineering data. Send your request on business letterhead or use the coupon, stating your occupation. Rodney Hunt Machine Co., 7 Water St., Orange, Mass.

96 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, colorimeters and similar devices. A 96 page booklet. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

Engineering Facts About Transite Pipe

83. This compilation of Johns-Manville's "Engineering Facts" series presents concise, factual information about Transite's many economic and engineering advantages, and includes informative case histories plus dimensions and data for your files. Write Johns-Manville, Box 290, New York 16, N. Y., or use the handy coupon.

Floatless Liquid Level Controls

92. Complete descriptions of electrode type floatless liquid level control systems, including control units, electrodes and fittings, panel assemblies and diagrams of typical installations for all types of municipal service are covered in the 32-page catalog of Charles F. Warrick Co., 1956 W. Eleven Mile Rd., Berkley, Mich. Check coupon for your copy.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2¼" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered.

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How a Reservoir Leakage Problem Was Overcome

103. The use of Laycold Weathercoat to form an impervious membrane in the construction of an excavated reservoir is the subject of an interesting bulletin offered by American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 4, Calif. Construction details for typical jobs are included. Check the coupon for your copy.

Specs for Gate Valves

112. Rigidly inspected gate valves for pressures up to 175 lbs. by R. D. Wood Co. Sizes 2" to 30"; for any standard type joint. R. D. Wood Co., Public Ledger Bldg., Philadelphia 5, Pa.

Makes Underground Pipe Installations Easy

115. One-man operated hydraulic pipe pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts ask for Form E-213, Greenlee Tool Co., Rockford, Ill. Just check the coupon.

Discussion of Ranney Method For Municipal Water Production

116. A very interesting study of municipal and industrial water supply problems and a complete discussion of Ranney Collectors for water production will be found in a 20-page booklet published by Ranney Method Water Supplies, Inc., Box 277, Columbus 9, Ohio. Water quality, construction methods, costs, performance and other topics are considered. Check the coupon to get your copy.

Pipe Detector Determines Exact Location and Depth

120. Determination of the exact location and depth of buried pipes, valves, service cables and other metallic objects can save costly digging and unnecessary damage. Your work can be speeded when you use the Detectron pipe detector, which features simple operation, shielding to avoid static interference, economical unit construction and a lifetime guarantee. Get full data from Detectron Co., 5631 Cahuenga Blvd., No. Hollywood, Calif., by using the coupon.

Complete Booklet on Pipe Line Equipment

246. Equipment for all types of jointing, maintenance and repair jobs on water, gas and sewer lines is described and illustrated in Catalog No. 25 issued by Joseph G. Pollard Co., New Hyde Park, N. Y. Leak detectors, pipe finders, melting kettles, cleaning tools and a full line of hand tools for water and sewer departments, and many other items are included. Be sure to get your copy now. Just check the coupon.

Water Lines Under Pavements Easily Installed

247. With a Trojan pipe pusher and puller no resetting of grip is required, so the work goes twice as fast. Two models, for pipe up to 2" dia. Get full details by checking the coupon. Trojan Mfg. Co., 114 Race St., Troy, Ohio.

What You Should Know About Turbine Pumps

294. In a colorful bulletin titled "Water Where You Want It . . . When You Want It" the Johnston Pump Co., Bin "K," Pasadena 8, Calif., gives details on turbine pumps with both semi-open and closed impellers; oil or water lubrication; and adaptations for any power source or combination thereof. Get your copy of bulletin 1013 by checking the coupon.

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check coupon for your copy.

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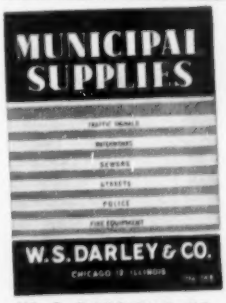

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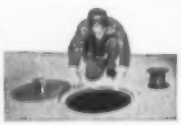

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JOSEPH G. POLLARD CO., Inc.
Pipe Line Equipment
NEW HYDE PARK, NEW YORK

Faster Pipe Laying With Precaulked and Threaded Joints

148. McWane 2" cast iron water pipe with threaded joints and precaulked bell and spigot pipe are described in folder WM-47. Additional data on 3" to 12" centrifugally cast pipe and fittings in folder WL-47, both issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala.

What You Should Know About Meter Setting and Testing Equipment

166. Complete details on all equipment and proper methods for meter testing and installation are included in an excellent book published by Ford Meter Box Co., Wabash, Ind. All waterworks men concerned with setting and testing of water meters should have a copy of this book. Write for Catalog No. 50.

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 8 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the coupon.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking coupon.

Locate Mains and Services Without Digging

186. A 16-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes and valves by electronic means. Proper manipulation also determines depth of cover. Battery operated unit is readily carried by one man. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co, Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the coupon

Investigate This Compact Flow Meter for Water

226. The Foster "Flow Tube" is a metering element that is compact and easy to install. Bulletin FT illustrates simple element containing nozzles for differential pressure production and shows capacity range and accuracy. Made in standard type sizes. Foster Engineering Co., Union, N. J. will send copy, or use coupon.

Helpful Data On Pipe Tools

230. Toledo drop head ratchet threaders are light, compact, ideally suited for work in tight corners. Three models for ¼" to ¾"; ⅛" to 1¼"; and ½" to 2" pipe all feature quick change of sizes. Get Catalog 11a52 from Toledo Pipe Threading Machine Co., Toledo, Ohio. Check the coupon.

Helpful Valve Catalog For Engineers

236. For complete descriptions of Darling double disc, parallel seat gate valves be sure to get Bulletin 5002 issued by Darling Valve & Mfg. Co., Williamsport, Pa. Construction details covering all valve parts and accessories are helpful for specification writers. Check the coupon for your copy.

Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the coupon or write F. B. Leopold Co., Inc., Dept. PW, 2413 W. Carlson St., Pittsburgh 4, Pa.

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251. The Hellige "Chromatron" features selective color filters, square and round absorption tubes, hermetically sealed photocell and automatically focused bulb to permit analysis of water and sewage using Standard Methods or any other colorimetric procedure. Full information from Hellige, Inc., 877 Stewart Ave., Garden City, N. Y.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in a convenient booklet offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the coupon.

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What You Should Know About The Centriline Process

197. The Centriline method for lining mains in place to stop leaks, prevent corrosion and increase carrying capacity is fully described in a handsome booklet issued by the Centriline Corp., 140 Cedar St., New York 6, N. Y. Many illustrations and typical case histories show the operation and economies of this process. The Tate process for lining smaller mains is also covered. Check coupon for your copy.

Are You Ready Now To Make Main Repairs?

214. Broken water mains can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Get Skinner Catalog 41 now—this handsome 40-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. Just check the handy coupon for your copy. M. B. Skinner & Co., So. Bend 21, Ind.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the coupon for full information including table of filter sizes and capacities, space required and filter operation.

What You Should Know About Steel Reservoirs and Standpipes

163. In a handsome 24-page booklet "Horton Steel Reservoirs and Standpipes," the Chicago Bridge & Iron Co., Chicago 4, Ill., shows installations from 50,000-gal. to 10,000,000-gal. capacity with several types of roof and special architectural features. Engineering data includes information on capacities, foundations and improved surface protection. Check the coupon to get your copy.

Cleaning Service for Every Type of Pipe Line

302. Flexible Pipe Cleaning Co., operating with specialized equipment and trained crews, is prepared to remove scale, rust and other deposits from pipes for every type of service. For details and estimates furnished without obligation write Flexible Pipe Cleaning Co., Box 167, Los Nietos, Calif. or check the coupon.

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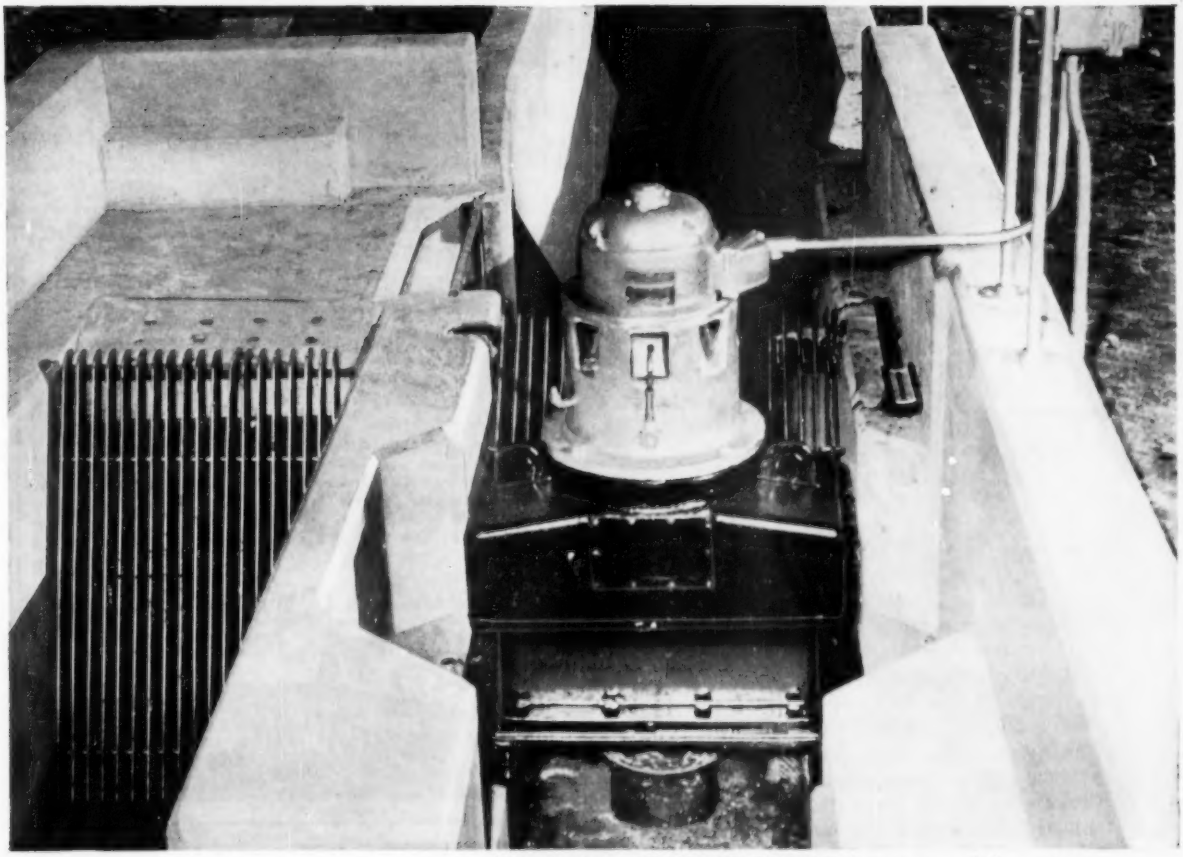
Helpful Data On Outdoor Lighting Equipment

63. A complete catalog of standard Union Metal brackets, mast arms and accessory attachments for poles of every type, and including mounting instructions and illustrated construction details is now available from Union Metal Mfg. Co., Canton 5, Ohio. Get this important reference booklet by writing to the company, or check the coupon.



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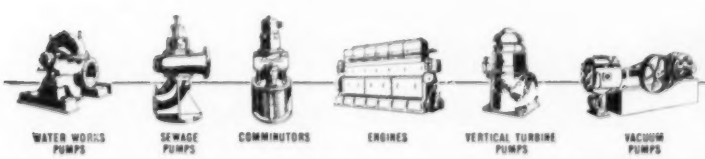

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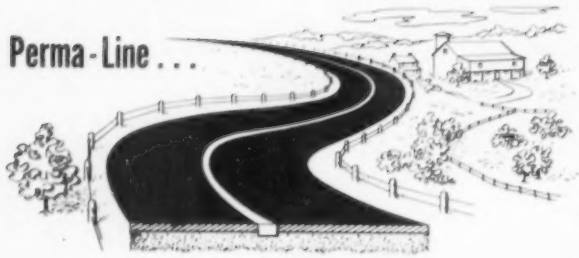

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BUSINESS AND ADMINISTRATION

Booklet Outlines Scheduled Preventive Maintenance

223. An interesting case history on reduction of equipment failures and less "down-time" through scheduled preventive maintenance is offered by Remington Rand Inc., Management Control Library, 315 Fourth Ave., New York 10, N. Y. Ask for Folder KD656 or check the handy coupon for your copy.

CIVIL DEFENSE

Get the Facts on Air Raid Sirens

86. There's more to be considered in air raid warning sirens than the loudness of the signal. Get complete information on efficient size and spacing of sirens from Federal Enterprises, Inc., 8733 So. State St., Chicago, Ill., by using coupon.

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Sanitary Landfill Operation and Methods

28. The location and area requirements for sanitary landfill, operation methods for trench type and area fills, equipment selection and costs are items discussed in an 8-page booklet issued by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Be sure you have this reference when considering the problem of garbage and refuse disposal. Check the handy coupon today.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy coupon.

Get Latest Data On Colecto-Pak Units

243. A feature-packed, two-color bulletin telling all about the Colecto-Pak garbage collection unit has been issued by the Heil Co., Milwaukee, Wis. Action photos and cutaway views show the ease of loading and unloading and illustrate the effective compacting arrangement that means bigger loads and lower costs. Get the full story by checking the coupon.

Thinking of Sanitary Fill? Get This Booklet Now

285. Good management of sanitary landfills requires rugged, dependable equipment to excavate dirt, compact refuse and handle cover material. Such equipment, in use on landfill projects coast to coast, is featured in a new 8-page booklet titled "Community Workers," issued by the Caterpillar Tractor Co., Peoria 8, Ill. Check the coupon for a copy.

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I., N. Y. Check the coupon now to learn how your collection problems can be eased.

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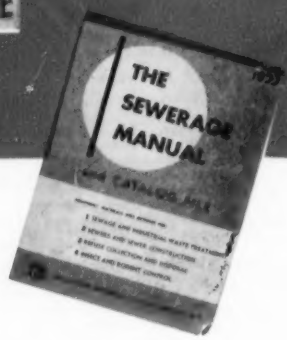

This year it is estimated that close to 400 million dollars will be spent *in new construction alone* for sewage and refuse disposal, rural sanitation and industrial waste treatment. No small responsibility. How can you be sure you're getting the best and the most for the taxpayer's dollar . . . that there isn't some short cut you've overlooked . . . some better way of tackling a problem?

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BOILERS 10 STORIES HIGH!

Three new B-I-G boilers on the West Coast will have all of the cost-saving advantages of B-L tube-supported wall enclosures and Texad* finishes. The order for one of them—a 1,250,000-pound-per-hour unit—has just been placed. Construction on the others—850,000-pound-per-hour boilers is now being started.

That means they'll cost less, save steel, operate more efficiently.

Those same advantages can be earned by specifying Bigelow-Liptak suspended settings for any large size industrial or public utility boiler. In California, for example, the king-sized, 10-story boilers will have lower construction and material costs and will not need tough-to-get steel plate.

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If you are building a large boiler, or a small one, insist on a separate enclosure quotation. You'll save plenty and you'll get a specially-made boiler enclosure engineered for your particular furnace by people who do nothing else but build furnace enclosures. Write Detroit today, or contact one of our conveniently-located offices. Be sure to ask for a copy of our 12-page tube-supported wall catalog—and a TEXAD* folder.

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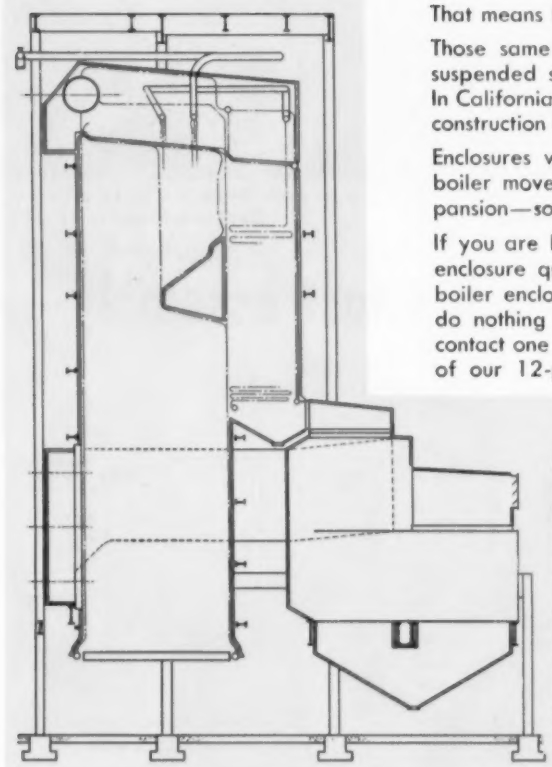

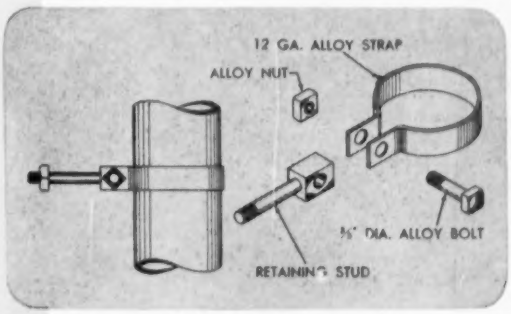

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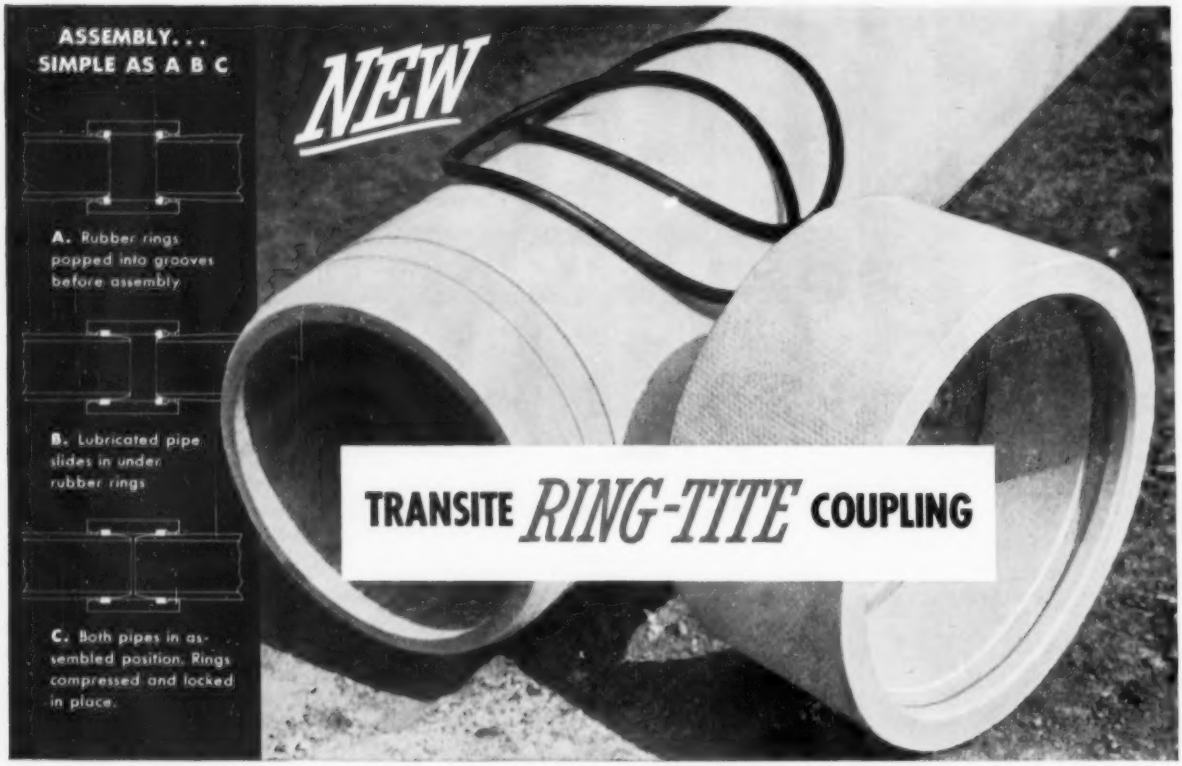
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JOHNSTON	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
PUMP "A"	EXTRA CHARGE			YES	YES	YES		EXTRA CHARGE	YES	YES	
PUMP "B"				PART OF IMPELLER	YES	YES			YES	YES	
PUMP "C"	EXTRA CHARGE	EXTRA CHARGE		YES	YES	YES	YES	EXTRA CHARGE	EXTRA CHARGE	EXTRA CHARGE	YES
PUMP "D"	EXTRA CHARGE	REPAIRS ONLY				YES		EXTRA CHARGE	YES	YES	
PUMP "E"	EXTRA CHARGE	END SEAL YES	YES	YES	YES	YES	YES	YES	YES	YES	
PUMP "F"	EXTRA CHARGE	EXTRA CHARGE		YES	YES		YES	EXTRA CHARGE	EXTRA CHARGE	EXTRA CHARGE	
PUMP "G"				SO-CALLED SEAL	YES	YES		YES	YES		
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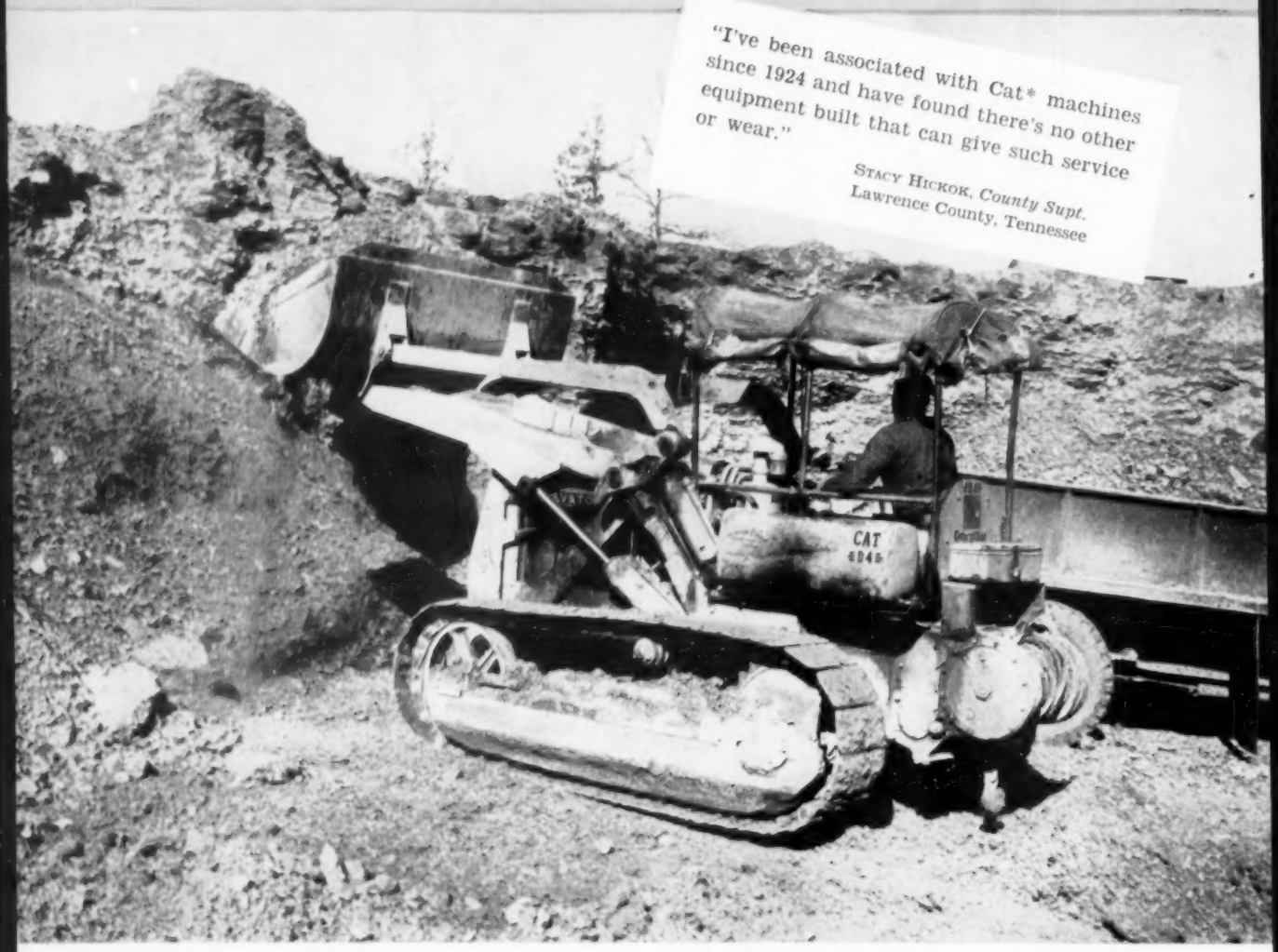
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PUBLIC WORKS Magazine

Volume 85, No. 1
January, 1954

● FLOORS of the 5 digestion tanks were constructed by pouring ten segments for each.

ECONOMICS of SACRAMENTO'S

Sewage Treatment Plant

GUY BROWNING ARTHUR

THE new $5,000,000 sewage disposal plant which Sacramento, Calif., is building rises on social and civic economics. Assistant City Engineer J. Carl Jennings pinned it down clearly in a speech before the local section of the American Society of Civil Engineers. His view is that any such plant must be designed with criteria which grow naturally out of the social and civic, the present and future needs of the community. This is the basis laid down by Bartley W. Cavanaugh, City Manager, and E. A. Fairbairn, City Engineer.

When he talks about the project he uses language that the doctor, the mechanic, and Mrs. Jones readily understand, but he leaves no doubt that the interpretation of the criteria is a job for the professional engineer. A lot of this one-syllable explaining is being done, for the sewage plant is only the largest of the public works projects in the most ambitious program the city has ever had.

The city lies within a loop made by the Sacramento River, which flows southward outside the western limits, and the American River, which flows along the northern boundary, joining the Sacramento above the city's northwest corner. Through its century of existence Sacramento has discharged combined storm and sanitary sewage into the main river. It draws most of its water from the same river. Therefore it has a heavy stake in the purity of the stream.

As the capital of California, and because of industrial gains, the city has grown like a weed. This growth has been orderly. Residence sections and industrial sections have been kept in place. So the disposal needs of the city are easily analyzed. But suburban areas have been closely settled, especially north of the American River, and some have been annexed by the city.

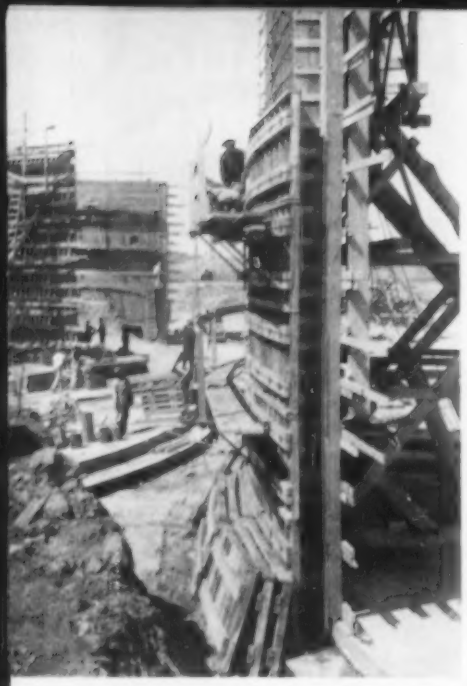
In 1949, when design criteria were first established, Sacramento had a population of 122,000, which today has risen to 155,000. On the base date the entire population of the metropolitan area was about 188,000. For today there are no dependable figures on total population.

To determine what the capacity of the new plant should be by 1970 the five outside areas were asked to reserve enough capacity to meet their needs. The city estimated its own needs. Then some juggling had to be done because the flow from outside areas does not add significantly to the total. This is because the peak flows from the outside areas do not come at the same time as the peaks in the city flow.

The assignment of capacity to participants was as follows:

City of Sacramento	74.8%
North Sacramento	2.5
Sanitation District No. 1	13.6
Sanitation District No. 2	5.2
Arden-Watt Maintenance District	1.4
Hagginwood Sanitary District	2.5
	100.0%

A daily flow of 54 MG in the year 1970 was used for the design of the plant, with a permissible overload of 50%, or a total of 81 MGD. This allowance for overload is necessary



● **GOING UP! Walls of one of five digesters shown under construction.**

to provide for peak dry weather flows of short duration, and also to give flexibility for wet weather. Since storm water is carried in the same sewers this was a trickly factor in designing. At times the storm flow goes higher than 500 MGD. It is now to be handled by passing it directly to the river at upstream stations.

Another factor was the location of the plant. Unlike many other cities, Sacramento is building its treatment plant between two choice residential districts. Added to other criteria, this calls for particular attention to the disinfection phases of treatment, to make good on the promise that there will be no objectionable odors to contaminate the neighborhood atmosphere.

One more element in design should be mentioned: the industrial load from the food processing plants in the area. This load is far heavier than the sanitary load normally expected from an average populated area. Its effect is to make the digester capacity and the sludge-handling equipment more dominant in the design than the capacity stated conventionally in a flow of millions of gallons per day.

The shift to the disposal of sewage was bound to come sooner or later. Steadily increasing public objection to the pollution of streams brought a cancellation from the State of California of Sacramento's permit to discharge raw sewage into the river. Similar action had been taken against the suburban areas, forcing them to consider plants of their own or joint construction with Sacramento.

Sacramento's attitude is noteworthy. As Carl Jennings puts it: "Our municipal neighbors upstream have, in most cases, done a good job of pollution abatement. That protects our water supply in the Sacramento. The least we can do is the same for those below us on the river. . . The application of the Golden Rule demands we do no less."

Sewage is now pumped into the Sacramento River at two points. All of it is collected to these two pumping stations by the combined storm and sanitary system of mains and laterals. No changes will be made in this collecting system. When outside areas increase their flows, new mains will bypass the city system and run directly to the treating plant.

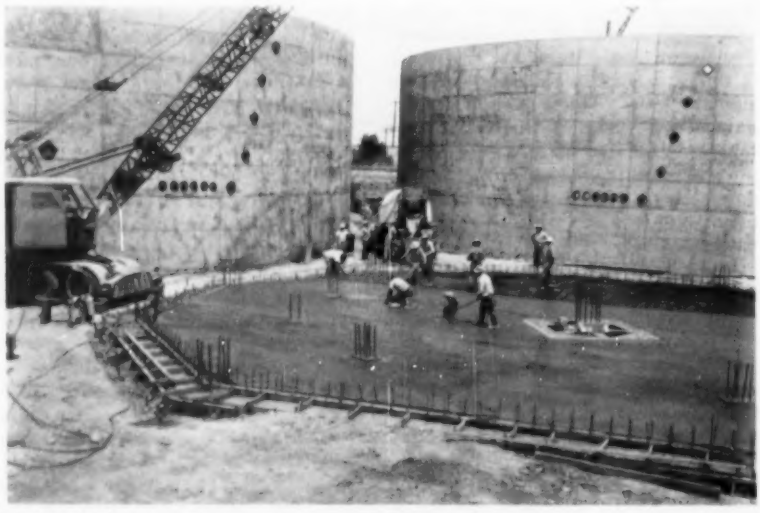
The first step was to connect the two pumping stations with a 60-inch reinforced concrete pipe fitted with rubber gasket joints. Fortunately Station No. 1 is high enough to permit of gravity flow to Station No. 2. But the elevation of this 60-inch main is below permanent ground water table, and the soil conditions are poor. So Lord & Bishop and Lentz Construction Company, two Sacramento companies which have taken the contract for this line jointly, will have some interesting problems. Their bid for the line was $417,500, and they were to start as soon as ground water would permit.

When the flow is concentrated at Pumping Station No. 2 it will be pumped through a 72-inch line into the headworks of the treating plant, which is two miles down-river. The plant is elevated to permit of gravity flow for the effluent to the river, about 1 mile away, for 8 or 9 months in the year. Pumping will be required when the river is at high stage. Stockton Construction Company, of Stockton, California, took this job at $712,000. It is manufacturing its centrifugally cast concrete pipe in a new plant established for the job on Power Inn Road.

Treatment Plant

The contract for the plant is the largest single award ever made by the city. It went to Stolte-Early Construction Company, of San Francisco, another joint operation, for $3,596,500. Work started early in December, 1952, and the plant may be completed in February 1954, six months ahead of schedule. This plant includes these structures: Headworks, for sewage measurement and grit removal; 10 combined aeration, grease removal and sedimentation tanks; 5 digestion tanks and a control building; 2 elutriation tanks; and 6 buildings: sludge filtration, administration and laboratory, chlorine treating, sludge pump, effluent pumping, and combined machine shop, storage and garage. There is also a complete water system with 2 wells and a Chicago Bridge & Iron elevated tank.

Prechlorination is the first step in the treatment. Disinfection bobs up constantly, emphasizing the care being taken to operate a plant successfully without making the citizens



● **SLUDGE digestion building will be located in the center of the ring of five digestion tanks. Wall footings are in place and floor is being poured at this stage.**

aware of it—a rigorous standard for a sewage plant. Wallace and Tiernan units are used for both pre and post chlorination.

The sewage passes through grit removal tanks of such cross section that the velocity of flow is reduced to 1.25 fps, so as to settle the grit out and retain the lighter organic material in suspension. Screw conveyors wash the grit and remove it from the bottom of the tanks. It is to be buried on the plant property. Equipment for grit removal was furnished by Link-Belt.

Comminutors take the place of screens, hoping to eliminate the nasty job of cleaning screens. Sacramento has a heavy fall of leaves, and officials seem to think this surge of mean debris on the autumn rains will be a tough ordeal for the Chicago comminutors. But once the coarse solids are ground up they are easily disposed of.

moval is expected to reach 65% of suspended solids. The effluent from these tanks will be chlorinated for odor control, and will then flow by gravity to the river, except when pumping is required.

A conveyor and cross-conveyor in each tank remove the sludge to Marlow plunger-type sludge pumps, which raise it to the digesters. These five digesters are circular tanks 100 ft. in diameter, 33 ft. deep, with PFT floating covers. These will provide 31 days retention time for digestion. Gas is expected to be produced at the rate of 450 cu. ft. per minute. Some of the gas will be used to heat the sludge as it passes through heat exchangers, and the remainder will be wasted by burning for the present.

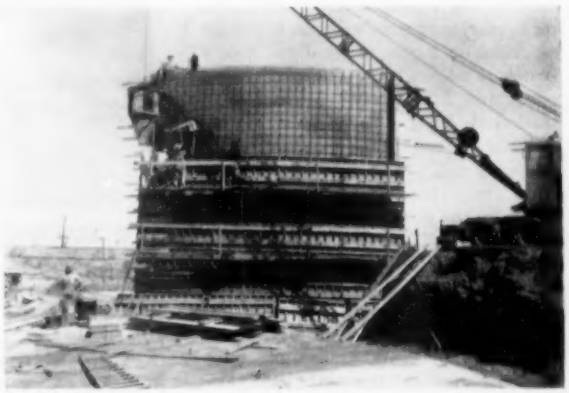
Elutriation — washing digested sludge with plant effluent—will come just ahead of vacuum filtration. This process will reduce the amount of

Milwaukee and San Francisco, and studied the possibility of selling the cake as fertilizer to farmers or dealers outside the city. It cannot be called good fertilizer. Its nitrogen content is only 2%. Milwaukee turns out sludge cake with 6% nitrogen, which has a better chance. The San Francisco Chronicle reports that city about to reject all bids for its sludge output, which is in the form of pellets, because the cost of dies for the pelletizer raises the production cost of the "fertilizer" to a prohibitive figure. So Sacramento has concluded to haul the cake out to waste land and dump it.

Construction of the Digesters

The Stolte-Early Construction Company moved a batching plant onto the site to turn out the 18,500 yards of concrete to be placed in the structures. Most of the work is conventional. Even pre-stressed

● **STEEL IS being placed for the floors and walls of the sedimentation tanks in this general view during construction.**



● **FIRST segment of a digester tank wall reaches its full height. Outside form is moved up the wall as work proceeds.**

After passing through four Builders equipped Parshall flumes for measurement the sewage goes to ten parallel tanks, each 37 ft. wide, 234 ft. long and 11 ft. sidewater depth, with Link-Belt sludge removal equipment. These tanks are for preaeration, grease removal, and settling of the suspended solids. The first 47 ft. of each tank is fitted with Process Engineering air nozzles, close to the floor, through which air is blown into the sewage at the rate of 0.10 cf/gal. This is to add oxygen, float the grease for skimming, and flocculate the sewage solids to speed their settling. Detention time in the aeration section of these tanks, will be about 30 minutes.

The remaining 187 ft. of tank length is for solids removal. Detention time in the settling end of the tanks will run up to 2 hours. Re-

flocculating chemicals which might otherwise be required. Tanks, which are really small sedimentation tanks, are provided for this purpose.

Two Oliver vacuum filters are 8 ft. in diameter by 14 ft. long. The treating chemical will be ferric chloride. The sludge cake will be carried out by a belt conveyor to hoppers.

There is a bit of irony in the design of such a plant. Every detail of handling the sewage is worked out with precision to the point where the sludge cake must be disposed of. There all know-how seems to stop, staggered by the job of disposing of the end product. It is like having a diesel-powered passenger locomotive come whizzing down the track at 80 miles an hour, and being stopped cold by a wooden barrier.

Sacramento's engineers investigated the sludge disposal systems in

tank construction has become common, but there are a few features in the job worth noting. The digester walls are 14 ins. thick, and are poured in 10 sectors, like barrel staves, each sector being 32 ft. long on the curve.

When all the sectors are finished the tank is wrapped with high tension wire, about 12 gauge. The tension is maintained by a carriage which travels round and round the tank. At the bottom there are 65 wires per foot, and the spacing becomes wider until there are only 4 per foot at the top. To prevent the entire job from unwinding if the wire should break, the wire is tied to anchors at intervals.

Initial stress in the wire is 120,000 psi, and the final stress is estimated at 90,000 psi. This stretch reduces the diameter of the wire about one-

(*Continued on page* 119)

How Public Relations help Citizens to "KNOW BROOKFIELD"

PHIL HIRSCH

EVERY Sunday afternoon, residents of Brookfield, Ill., near Chicago, have a guest—Village Manager C. Harold Eash comes into their living rooms and discusses the community's public affairs. Eash's audience, comprising a large percentage of Brookfield's 17,000 citizens, meets their village manager by radio on a program called "Know Brookfield," which started three years ago. It is broadcast on a local station, WTAQ, from 1 to 1:15 pm.

"Know Brookfield" is designed to "supplement" rather than compete with the village hall coverage provided by the community's two weekly newspapers and the radio station's regular news broadcasts, Eash explains. He adds that "our broadcast picks up a story where the newspapers and radio drop it. Many times, the space and time limitations of these media prevent the taxpayer from learning more than the high spots of municipal affairs."

Inadequate communication between the public official and the taxpayer is a serious problem in many communities, yet few public officials realize, apparently, that by taking to the airways themselves, much of the difficulty can be eliminated. According to the 1952 Municipal Yearbook, only 24 of the 16,677 municipal governments in the United States present their own radio programs. In other words, for every community that has such a program, there are 694 that don't.

What makes these figures more significant is that air time is available to municipalities for the asking in most cases. Every U. S. radio station is requested by the Federal Communications Commission to devote a percentage of its program schedule to public service broadcasts. Such programs, which make up from five to ten percent of the average station's air time, are almost always handled at no cost.

● BROOKFIELD'S radio program under way, Mr. Eash at right, Mr. Kulie, left.

At present, most public service radio fare consists of transcriptions distributed by such agencies as the federal government and American Red Cross. There are few stations which wouldn't jump at the chance to replace this type of program with a community affairs broadcast conducted by a municipal official.

The success possible with a municipally-conducted radio program is indicated by the "Know Brookfield" broadcasts. When Village Manager Eash asserts modestly that these programs "supplement" the press, he's covering a lot of ground. For his Sunday afternoon chats with village residents actually improve relations between Village Hall and the taxpayer in a hundred and one ways.

Last summer, Brookfield officials asked the Cook County Traffic Safety Committee to survey parking space in the village. When the survey was finished, the committee made several recommendations, one of which made some property owners unhappy. The committee suggested that. in the blocks adjacent to Brookfield's main business district, daytime parking be limited to four hours.

Property owners in these blocks were put out because the recommendation, if adopted, meant they wouldn't be able to park their own cars all day in front of their homes. There was a certain lack of logic, familiar to all municipal officials, in the property owners' attitude. The affected area is near a railroad station. Villagers commuting to Chicago left their cars in front of homes near the station all day. As a result, many of the complaining property owners were already deprived of curb space. In fact, this was the reason for the traffic committee's recommendation in the first place.

When the traffic committee's report came up for a first reading before the Brookfield village board, several property owners were on hand to object to the four-hour parking limit proposal. Then, on the "Know Brookfield" program, the commuter parking problem was discussed. The disgruntled property owners were told that, although some of them would be able to find space for their own cars if things were left as they were, no home owner in the area was guaranteed a space. It all depended on how many

(Continued on page 117)

● **ROUGHNESS, expressed in units of vertical movement per mile, is indicated cumulatively on recorder. Readings are logged for each half mile.**

SIX USES for a ROUGHOMETER SURVEY

DEAN SMITH

FOR the first time in its history, the Arizona State Highway Department now has a scientifically accurate method for measuring the smoothness of its paved highways. And the Roughometer—an electronically controlled measuring device rented from the U. S. Bureau of Public Roads to make the measurements—is expected to give the department the answers to several other questions.

Here are some of the uses to which the Roughometer survey will be put:

1. The readings made during the survey will serve to pin-point critical sections which can be improved with comparatively inexpensive maintenance.

2. A greater competitive spirit among Arizona road building contractors should be created, since an accurate measurement of surface course smoothness will be available in inspections.

3. Useful comparisons of the effectiveness of different construction methods in laying highway surface courses should be established.

4. Readings should be valuable in studying the effect of age and traffic volumes on road surfaces, as well as degree of winter frost action in the colder portions of the state.

5. Since the department knows, by means of traffic counts, the number of overweight trucks which travel various sections of the highway system, the readings should give an indication of the effect of such overweight loads on surface courses.

6. Finally, if the machine can be obtained in the future at specified intervals, the department will be able to measure the service qualities of various types of surfaces over a period of years.

The primary purpose of the Roughometer survey, however, was to provide a greater measure of accuracy and consistency in the "roughness of texture" component in the department's highway sufficiency rating system. Before the survey, this element had been a "seat of the pants" measurement, arrived at simply by driving over the highway and noting the apparent roughness. But it was realized that the type and condition of the vehicle used, together with other variable factors, made that estimate an uncertain one.

Arizona's Survey

Arizona's Roughometer survey, conducted under the direction of William E. Willey, engineer of the Division of Economics and Statistics, was started in late September, 1953. The highway department arranged for rental of the Roughometer, at the rate of 11 cents per mile, through the Denver office of the Bureau of Public Roads. The New Mexico highway department had just completed a similar survey and the device was obtained from that department.

The Roughometer is a single wheel semi-trailer with associated electronic recording equipment. The vertical movement of the trailer wheel is transmitted through a cable to an integrator, which shows units of roughness on a recorder located in the front seat of the vehicle pulling the trailer.

The device has a wheel reaction of 580 pounds, carried by a pair of frictionless leaf springs pivoted forward and shackled at the rear. For uniformity, it uses a single leaf spring with ball bearing mountings. The frame is built of standard steel channels, attached to a Y tongue, so that the entire apparatus, acting as a pendulum, has its center of percussion on a vertical line through the axle.

In the Arizona tests, the device

● **LOOKING the job over. Left to right are: Brad Miller, project chief of survey; Ray Johnson; R. E. Hinckley; Wm. E. Willey, the engineer; and J. R. Miller.**

was loaded into the back of a Chevrolet carryall and transported to the section to be measured. Two men operated the test, one driving the carryall and the other transferring the Roughometer readings to a log. The department found that best results were obtained when the vehicle was driven at 20 miles per hour. Accurate readings can be obtained at higher speeds, but under many hill and curve conditions the vehicle could not travel at more than 20 miles per hour—and the department wanted all data obtained at a constant speed.

Roughometer readings are given in terms of units of vertical movement per mile. Tests showed a unit of roughness to be virtually equal to an inch of roughness, so the terms were used almost interchangeably.

Since the Roughometer records its roughness units cumulatively, from the time it is put into motion until it stops, the keeper of the log made an entry of the accumulated reading at each half mile mark along each route. Readings were also taken at check points, such as bridges and other landmarks. In that manner, the department now has a roughness measurement not only of the highway between two cities, but of every half mile of paved highway. Readings were made along every bit of Arizona's 3,500 miles of paved road.

To insure maximum accuracy, the two men stopped about every 20 miles to assure themselves that all factors were kept constant. The oil around the cylinder recording vertical movement in the Roughometer was checked, the pressure of tires on the carryall and the trailer was measured, and the trailer tire treads were checked and gravel removed.

Working from 8 to 12 hours per day, the two-man crew was able to log between 100 and 200 miles per day, depending on how far they had to travel to start each day's work.

One question that faced the highway department at the outset was whether it would be necessary to take readings from both directions on any given stretch of highway in order to get an accurate result. They made a test on a 10-mile portion of highway west of Phoenix and discovered that the east-west reading was almost identical with that made by going from west to east.

Because of that test, and others made on various other portions of the highway system, it was decided that one-way readings would provide sufficiently accurate results. The only exception was in the case of divided highways. Both portions of divided stretches were covered and results recorded.

When roughness readings from the entire 3,500 mile system had been logged, the Division of Economics and Statistics started the task of coordinating the results. The job is expected to be finished early in 1954.

One thing the division hoped to achieve was the establishment of a highway roughness standard—an accurately devised level of roughness which will be given a rating of "100" and will be used to compare the quality of new highway construction and the degree of deterioration of older roads.

Engineer Willey and his staff are convinced that Arizona's Roughometer tests have been well worth the necessary expenditure of money and time. They realize that the tax-paying public rates highways as "good" or "bad" primarily on the basis of how smooth or rough they are. Now, for the first time, the Arizona Highway Department has a scientifically accurate measurement of the roughness factor.

● **FREQUENT checks are needed. Here J. R. Miller tests oil in roughometer cylinder.**

• • •

Income From Parking

JOHN E. HUBEL

INCOME for parking space collected from motorists is a very respectable sum according to the report of the comptroller of the City of Milwaukee for the first six months of 1953. A total of 3,898 parking meters collected a total of $193,747.04 in the period or an average of $2.04 per meter per week. The weekly average varied from $0.86 to $2.73 depending upon the location of the meter. Naturally those in the downtown section were used the most.

In addition to parking meters the city sells all-night parking permits at the rate of $4.00 per month. A charge of $2.00 is made for permits issued after the 15th of the month. A total of $161,592 was received in the first six months of 1953, from the sale of 38,382 $4 permits and 4,032 $2 permits. The figures were about the same for the first half of 1952.

Upon the basis of the figures, the City can expect to receive over $710,000 per year from the rental of space for parking purposes. This money is segregated into two special funds to be used for the operation of the present facilities and the acquisition of additional parking meters or off-street parking areas.

As of June 30, 1953, the parking meter fund has an unencumbered balance of $378,957.29 and the all-night parking fund balance stands at $448,160.73. The all-night parking ordinance was passed in 1950. Evidently parking fees are a source of considerable revenue in Milwaukee.

How Sanitary Landfill Solved OUR REFUSE PROBLEM

E. R. WARNICKE, Superintendent of Public Works, Des Plaines, Illinois

WE have solved our refuse disposal problem here at Des Plaines with a sanitary landfill which has saved the city money and is also accomplishing a worthwhile service for a Catholic Convent in the city. A convent, naturally, seems like a strange place to locate a sanitary landfill operation, but the situation here is working out to the satisfaction of everyone concerned and it may set an example for other small cities having the problem of locating a landfill site. It is working out so well, in fact, that I have high hopes of expanding the operation in the near future by eliminating our old incinerator completely and disposing of both refuse and garbage by the landfill method. Right now the landfill is used for dry refuse only.

The unusual aspect of this situation is that the landfill location at the convent came as a godsend at a time when the city was desperate for a disposal site. The problem first came up late in 1951. All refuse was being dumped in a borrow pit in a nearby forest preserve. The forest preserve authorities notified the city it would have to start making arrangements for terminating dumping there and sealing off the pit, which was nearly full and was a breeding spot for many sorts of vermin, especially rats.

The city was on a spot. There was no dumping location in sight. It was almost decided to purchase a five-acre plot adjacent to the incinerator for the high price of $15,000 (we were that desperate); but then the convent situation came to light. City Engineer E. N. Fletcher remembered a request he had had several years previously from the Sisters of the Holy Family of Nazareth, for a large amount of dirt to fill some low ground. This Catholic order has a provincial home at the edge of the city—and a perennial water problem too. A low area located right behind the buildings was inundated by the nearby Des Plaines River at least once a year, and frequently twice. Many times the water came up to the very edge of the buildings.

The home couldn't afford to correct the situation. The Sisters had looked into the possibility of constructing a dike, but had to abandon the idea when they found it would cost $30,000.

With this situation presenting itself, Mr. Fletcher and I went to talk to the Sisters about turning their back yard into our sanitary landfill. They were somewhat cool at first, but we sold them on it by convincing them of the many advantages. In their case the water problem would be eliminated and additional usable area on their grounds would be available when the landfill was complete. We assured them that this could be accomplished without the usual plagues of rubbish disposal-smoke, odor or vermin.

We eventually agreed on a one-year renewable contract with a cancellation clause whereby the Sisters could end the contract at any time they didn't think an adequate job was being performed, or whenever they thought it was no longer accomplishing what they had anticipated. There was no money involved at all.

The first agreement was signed and operations started on May 20, 1952. Since then everything has run smoothly and the Sisters at the home are extremely satisfied with the situation. They renewed the contract at the end of the first year without hesitancy.

When the way was cleared for starting our newborn sanitary landfill operation, a Caterpillar HT4 Shovel was purchased. We definitely wanted a front-end shovel, such as the HT4, because of its versatility. In our relatively small operation the machine has to move and compact refuse; move dirt; load trucks and stockpile; and handle snow removal, land clearing and other maintenance problems that come up from time to time in other parts of the city.

The area we are now filling covers approximately seven acres and in 15 months we had filled almost half of it. We expect to have it completely filled late next summer since our refuse collections have increased considerably in the past year. However, thanks to the fact that we have taken care to perform a good job for the Convent, our landfill situation is solved for several years. When we finish at our present location we expect to move our landfill operations across the river to an eight-acre plot which also belongs to the Home. The Home owns another 15 acres of low land adjacent to the present landfill operations that the Sisters have expressed a desire to fill eventually.

● **AUTHOR: E. R. Warnicke has been with the city since 1947.**

The first thing accomplished in starting this operation was to build a levee similar to the one the Sisters originally had wanted. This levee stands about eight feet high and is wide enough for a truck to drive on. It is about a quarter of a mile long, bordering the east and south, or

● **OVERALL view of the Des Plaines landfill, showing portion of new parking area.**

river, sides of the landfill site, which runs north and south. It is built so that in case there is any seepage into the area that is being filled, a truck with a pump can be driven out on the dike and pump the water back into the river. This levee was built out of dirt excavated from the landfill, with the HT4 doing the excavating and also the shaping of the levee.

Besides the construction of the levee, there were several large trees to be knocked down and cleared away before operations could begin. This was also accomplished by the shovel. More excavating was done to define clearly the actual area that was to be filled. This dirt was stockpiled on high ground to be used in extremely wet weather or during the cold winter months when it would be difficult for the shovel to obtain dirt from the bottom of the pit.

However, in regular day to day operations we use dirt dug out of the pit to cover the refuse. The shovel digs out ahead of the location where the trucks are dumping and stockpiles enough on top for at least a half a day. The operator maintains a dirt ramp into the pit so that he can move in and out of the pit easily. After the trucks have come in to dump, the operator first levels off the refuse then starts compacting it by running over it with the unit and pressing it down with his shovel blade. He spreads the dirt he has stockpiled over the top to form about a foot of cover. He then moves down into the pit and further compacts the refuse by using the shovel to press it down and back. Before he finishes each day he covers the exposed bank of refuse with a layer of dirt to seal it off for the night, thus keeping the trash from blowing around, eliminating any odor and discouraging vermin from finding a home.

● **REFUSE is compacted by Cat HT4, which gets down into pit.**

The occasional deep fills—anything over eight feet—are filled half way with refuse; compacted and sealed off with about five inches of dirt. Then more refuse is dumped on top of that and sealed off. With this step-level method we have found we get much better compaction in these deeper areas.

In sealing off the top, the shovel operator puts down about a foot of fill, generally clay, and in areas where it is to be landscaped, another six to eight inches of black dirt is added.

Using the Filled Area

The area that has been filled is already being put to good use. Part of it has been seeded with grass to conform to other landscaping on the grounds and one would never know that it was once part of a sanitary landfill. The rest is being covered with five inches of coarse white rock, and that part which has been completed is being used for a parking area. Both the landscaping and the laying of the white rock were undertaken by the Home. When full settlement has been reached, the Home plans on asphalting almost the entire area. (This asphalt seal will be good insurance against vermin boring into the refuse.) It will become a recreation area.

The city's collection trucks start working at 4 a.m. They generally start dumping about 8 a.m. and are through by noon. The shovel operator comes to work at 8 a.m. when the dumping has just started and is through at 5 p.m. He works while the dumping is going on, but he has all afternoon to finish off the day's work without interference from the trucks. If he completes covering the refuse early, then he stockpiles dirt for the next day's operations and generally cleans up around the area before he quits.

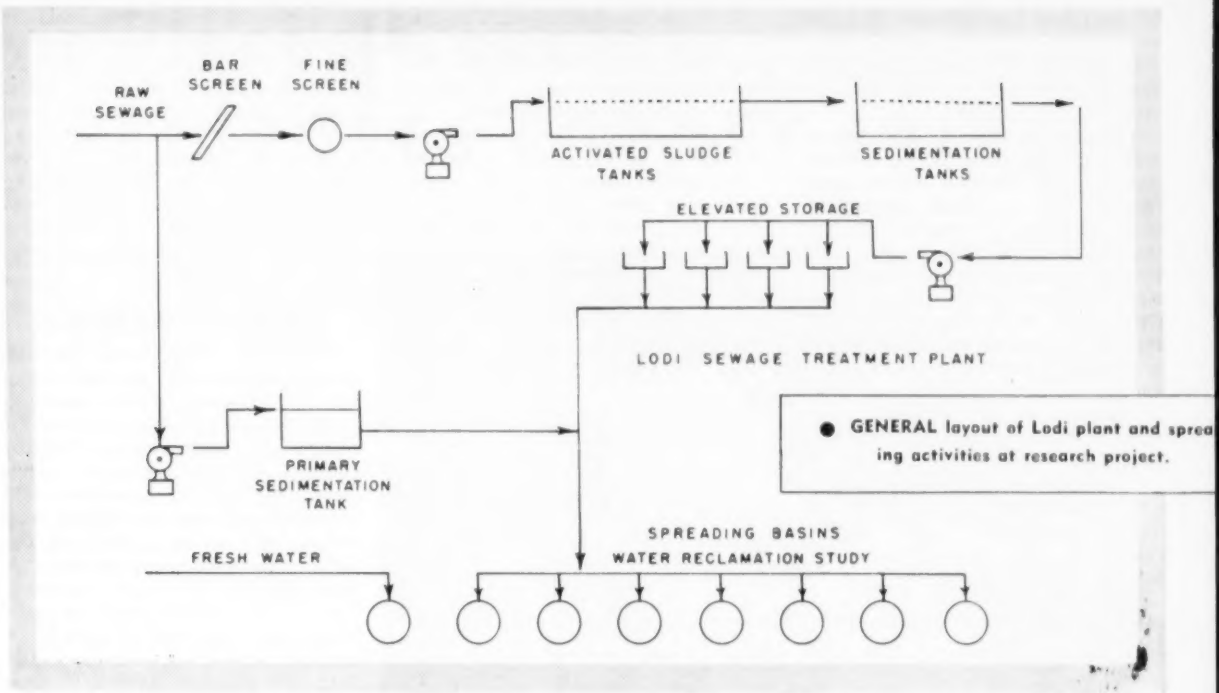
Since there is only one man operating on the landfill continuously the only cost there is the salary of the operator and the maintenance of the shovel. We pay the operator $4,000 a year for a 44-hour week. The operational expense of the shovel has been small since there have been no repairs on the unit as yet. The collection trucks and operators have not been increased with the use of the landfill method.

We recently started a plan for keeping cost analysis figures on all of the city's rolling stock, including the shovel. However, these figures are inconclusive as yet.

One big saving that has been realized in the sanitary landfill method over the open pit dumping has been in the replacement and repair of the tires on the collection trucks. In the old pit, the tires wore quickly and were frequently damaged by the cans, bottles, nails and debris that the trucks were continually running over to dump their loads. There is none of this with the new system. I would say that the average savings in tires alone during the time we have had the landfill would more than pay for the operation costs we took on with the addition of the Cat HT4 shovel.

The hauling is handled by four trucks manned by two men each. The trucks alternate between collecting refuse and garbage. One truck handles the commercial area and the other three cover the residential area. However, the volume is becoming so big that lately two

(*Continued on page* 62)



How Waste Water Reclamation Affects

GROUND WATER POLLUTION

IN those areas where water is a factor limiting growth and development, as is the case in many parts of California, the possibilities of reclaiming waste water are of much interest. One phase of this problem is the recharging of underground water basins by means of spreading ponds or injection wells. A further subdivision of this problem is the use of sewage effluents for the purpose. Pertinent questions are: How great can be the rate of application to an area, and how will the quality of the ground water be affected?

In order to develop answers to these and other similar questions, California's State Water Pollution Control Board undertook a research program. A federal grant provided part of the funds; money was also provided by the University of California for the work which was carried out by the Sanitary Engineering Research Project of the University of California, under Prof. Harold B. Gotaas. The investigative work was done principally by A. E. Greenberg of the Project staff, and he and P. H. McGauhey prepared the report. The results are reported in considerable detail in SWPCB Publication No. 6, which is a 124-page book. The data presented in this article are from that report. The work covered a period of 28 months.

Objectives and Conclusions

The principal objectives of the investigation included a study of spreading treated sewage on small field plots to determine the following:

1. The rate of percolation of industrial waste and sewage effluents on different soil types.
2. The most effective spreading and resting periods to obtain maximum rates of percolation.
3. The extent and degree to which mineral and organic matter, including bacteria, in the waste will penetrate different soils.
4. The changes in mineral and organic characteristics of both soil and waste (or water) at different depths during percolation.
5. The degree of treatment necessary for industrial waste and sewage in order to obtain satisfactory percolation rates, prevention of nuisance and contamination and protection of the underground water.
6. The cost of this method, so far as this might be possible in connection with the research program.

As a result of the study, the following conclusions were reported:

1. A bacteriologically safe water can be produced from settled sewage or from final effluent if the liquid passes through at least four feet of soil.
2. A water of satisfactory chemical quality results provided that the wastes applied to the ground do not contain high concentrations of undesirable chemicals.
3. A highly treated sewage effluent must be used for spreading in order to obtain high rates of percolation.
4. A percolation rate of at least

0.5 acre-foot per acre per day can be expected when spreading on a Hanford fine sandy loam. The characteristics of this soil are detailed later in this article.

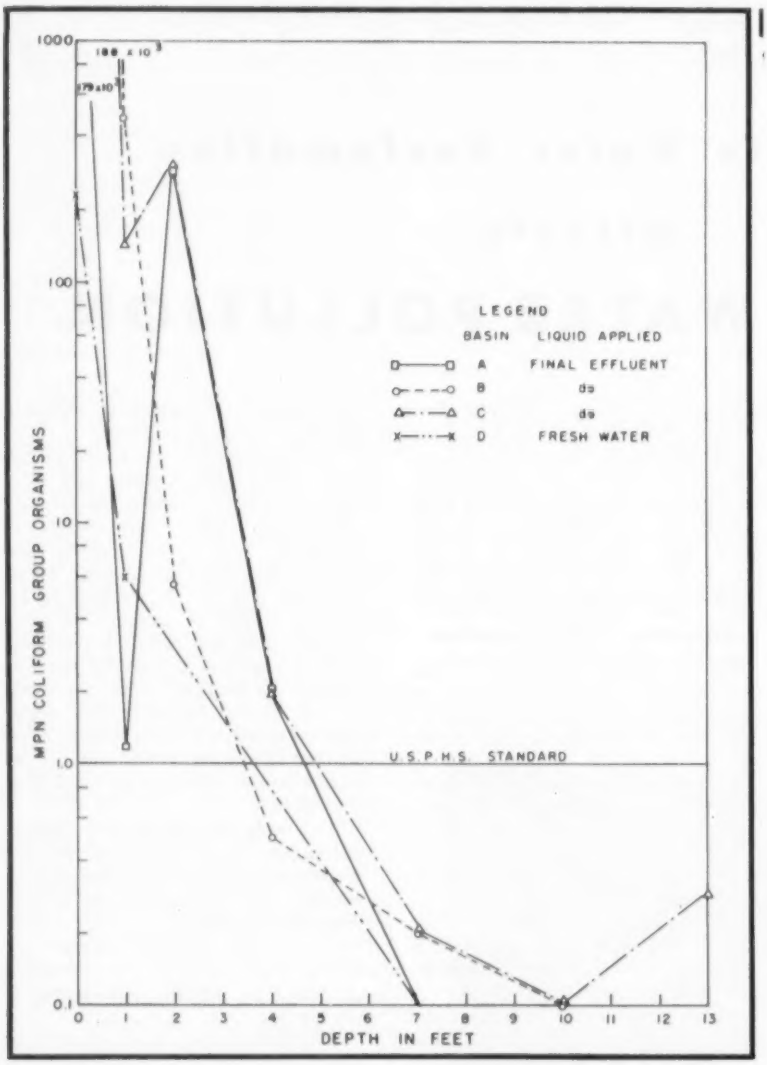
5. The best method of operating a spreading basin is to spread continuously for about a month, preferably with a liquid containing large amounts of organic matter; then to allow the area to rest until the moisture content is reduced to about the permanent wilting point. Cultivation of the dry soil appears then to be desirable. Following this preliminary treatment, continuous application of a final effluent may be carried on for as long as 6 months. Resting and cultivation may then be repeated.

6. Mosquitoes in spreading basins will create a nuisance, and in California may be a health hazard. Control of algae may also be necessary to prevent odors.

7. Since this investigation had to do primarily with one type of soil —a fine sandy loam—further investigations are needed to determine conditions in other soils.

As a result of percolation through 4 feet of soil, water is produced from settled sewage or secondary treatment effluent which conforms to Public Health Service bacteriological standards for drinking water. Chemically, the water after percolation differs little from sewage effluent from which it is reclaimed. Nitrate ion concentrations may be high. However, it is usually the case that dilution with ground water reduces the nitrate concentration.

Since a higher rate of percolation is obtained with a highly purified effluent, it is best to apply sewage that has been given effective secondary treatment. At the rate of 0.5 acre-foot per acre per day, an area of 6.14 acres would be required for a flow of 1 mgd. Provision for resting each section of the spreading field for 2 months each year, would increase this to 7.36 acres. Initial costs, in addition to the land cost, would include basin leveling, dike construction, piping and controls. Operation costs would include dike maintenance, pumping (in few cases would gravity flow from the plant be possible) and mosquito and, possibly, odor control.



● MPN of coliform group organisms expressed as function of soil depth.

Details of the Work

Site: The site selected for the research project was adjacent to the sewage treatment plant at Lodi, Calif. The plant is of the activated sludge type and treats a flow of about 2 mgd. Treatment units include a bar screen, a mechanically cleaned fine screen, an aeration tank and a settling tank. BOD of the plant effluent ranges from 10 to 15 ppm; turbidity is about the same. There is no primary settling tank, but a sewage of about 100 ppm BOD, was provided by a temporary settling tank of about 3,000 gals. capacity. Some modification of the piping system at the plant was necessary.

Soil Type: The soil at the site is classified as a Hanford fine sandy loam, a recent alluvial soil which overlays uncompacted alluvium. It is neutral in reaction. Though there are some clay lenses, permeable conditions exist to a depth of about 13 ft. For four spreading basins, A, B, C and D, soil data are as shown in Table 1, page 104.

The water level at the site was at least 22 ft. below the surface.

Permeability of undisturbed soil cores was determined on surface samples in the conventional manner. Cores were taken with an impact core sampler and were in the form of a cylinder 7.5 cm in diameter and 7.5 cm in depth. Distilled water was applied at a constant head of 25 cm of water to the bottom of the upright core. The amount of water flowing through the core was measured and the permeability calculated from:

$$P = V/J = Q/AT \times L/H$$

where V = velocity; J = hydraulic gradient; Q = quantity; A = cross-sectional area; T = time; L = length of core; and H = head of water. The steady percolation rate obtained after 30 minutes of percolation was reported. Disturbed soil samples

(*Continued on page* 104)

Air Placed Concrete RESTORES COUNTY BRIDGES

A PORTABLE rig for repairing and maintaining concrete bridges developed by the Kentucky Dept. of Highways has completely paid for itself in a little over three months. This rig, operated by the Department's own crew, travels throughout the state, performing repair and preventive maintenance on the state's more than 4,000 concrete bridges. T. J. Hopgood, Asst. Director of Maintenance says, "Our unit makes it possible to accomplish far more concrete bridge repairing than ever before on our annual maintenance budget."

According to Mr. Hopgood, the rig completed repairs on fifteen bridges in the Flemingsburg district of Kentucky plus scattered work in other areas between late July and November 15, 1953. He adds, "By having our own crew to do this work, we cut costly engineering investigation, inspection and preparation of specifications which would be required if each job were let as a separate contract."

The rig consists of a Model 1250-S Bondactor concrete gunning machine, a Mix-Elvator, which is a combination dry mixer and elevator, and a 105 CFM air compressor mounted on the back assembly of a straight truck. The crew has found that such a set-up has many advantages. It is possible for them to feed material into the Mix-Elvator from a dump truck, eliminating stockpiling of materials at the job site; the portability of the rig eliminates the necessity for barricading highways except during the actual operation; and a single line of highway traffic is possible during operations, with normal two-way traffic after working hours.

The feasibility of the operation became evident after repair of a bridge in Rowan County, Kentucky, was studied by department engineers. It was first believed that a new bridge would have to be constructed on the site of a twin, 40-foot concrete deck girder span bridge on Kentucky Highway 32 between Flemingsburg and Morehead—at an approximate cost of $25,000 to $30,000. Originally constructed in 1932, the bridge had suffered extensive

● **AFTER mesh and reinforcing steel were secured in place, abutments, decks, beams and columns were resurfaced. Bondactor produced no-slump concrete.**

● **HERE is the rig that was used for repairing Kentucky bridges, mounted and ready to move wherever needed. It paid for itself in a little more than 3 months.**

● **THIS IS the way the Rowan County bridge appeared after being repaired. As a result of this work, the bridge can now carry its former rated loadings.**

spalling damage with subsequent deterioration of the concrete.

Chipping, followed by sandblasting with the Bondactor machine, was required to cut the rust on exposed reinforcement. New reinforcing steel was welded into place and, on large wall areas, mesh was tied into the wall with steel anchors. Because of the condition of the bridge, it was necessary to shoot concrete to thicknesses of 1 inch to 5 inches. However, due to the low water ratio and dense compaction of air placed concrete, it was possible to build the surface up adequately with just one application. The total cost for the complete restoration of the bridge with the portable rig, utilizing the shot concrete method, was only $3,500. The State Highway Department had first become interested in Bondactor concrete gunning equipment, manufactured by Air Placement Equipment Co., Kansas City, Mo., when they saw the equipment at work on the Kentucky State Capitol Building at Frankfort, Kentucky.

The manufacturer's engineers cooperated in developing the mounting of the equipment on the truck assembly and supervised training of the state crew operators. After only a day and a half of training, the crew was prepared to do maintenance and repair work with the equipment with no further outside assistance.

A big factor in utilizing the Mix-Elvator on the rig is that the device has a ratio mix control. By presetting at the desired ratio (1:3 to 1:8), measuring of amounts of sand and cement during mixing is eliminated and a constant ratio of blended materials is assured. This device also cuts down on unnecessary handling of materials and screens foreign materials from the sand and cement. Elevation of the materials to the overhead hopper makes constant, automatic feeding of material into the Bondactor machine effective and fast.

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Des Plaines Sanitary Landfill Operation

(*Continued from page* 58)

street department trucks have been called in two days a week.

To keep an accurate account of the amount of refuse handled over any determined period, each truck driver is given a card as he starts work. After each load is dumped, the card is punched by the shovel operator. This also acts as a check on the drivers to see that they are perfoming their jobs properly. These cards are turned into my office each week.

From May 20, 1952 until the end of that year—just over seven months—1,013 loads of refuse were dumped in the landfill. To give some idea of how the problem is increasing, in the first eight months of 1953, 2,237 loads were dumped. Figuring roughly four yards per load this amounted to 8,948 cubic yards of loose material deposited in this fill during the 1953 period.

Des Plaines has a population of slightly over 20,000 with much of its growth since the war. Our refuse collections have tripled in the last three years.

We are just getting a good start in this sanitary landfill method and I have hopes of making still more improvements on it. It is planned to dispose of our garbage as well as the refuse by this method, thus permitting a combined pick-up to be made and eliminating the necessity of covering the City twice in the same week. I hope to purchase two load-packer type trucks which can carry about four times the amount of our present dump trucks. In using these, the material is packed as it is loaded, thus performing some of the compaction which is now done entirely on the landfill site by the shovel. We would also eliminate our old incinerator, which we have had since 1928, and dump both garbage and refuse in the landfill. This would provide a big saving since the man maintaining the incinerator would no longer be needed there; the expense for fuel and repairs would be eliminated. All of these proposals, however, still have to have the approval of the City Council.

A sidelight on an operation such as this is the fact that at all times we make a conscious effort to maintain healthy relations with the Sisters at the Convent. Frequently we will assist them in problems they have that don't always fall under the category of official city duties. However, because of this there have been no incidents between the city and the Convent that would cause any trouble and eliminate a good thing for both of us.

We didn't get into this location because of any religious affiliations. Neither Mr. Fletcher nor myself belong to that faith. It just happened that the Convent had the answer to our problem at the time and we were happy to work out an agreement.

Disposing of garbage and refuse properly is one of the big problems facing many cities these days. In my mind there is no doubt that sanitary landfill offers one of the cheapest and most practical ways of handling this problem. At Des Plaines we happened to be lucky enough to be able to install the system in a location where it can accomplish good for everyone concerned.

4 musts for BETTER STREET CLEANING

LEM D. MERRILL

Supt. of Streets & Garbage, Birmingham, Alabama

This article is based on a panel discussion at the American Public Works Congress. Mr. Merrill is second from left, at the top, facing the camera.

STREET cleaning is one of those commonplace jobs required of a Public Works Department. It is a continuous daily proposition, with nothing spectacular to be performed; and yet, from its performance is determined to a large degree, a visitor's impression of the general physical condition of a city.

With the same effort expended, it is possible that during one season a good impression will be created; while during another season a much poorer one will be made. During one season, there may be long periods of rainfall; heavy building construction; or an unusual leaf crop—or all the leaves may fall at one time. Any of these conditions, or a combination of them, may occur to change our problem from year to year. Also, most cities have found that, in these postwar years, more work must be done in street cleaning in less time in order to keep up with prewar standards.

There are four *"musts"* that are essential to successful operation of the street cleaning department. They are: (1) good ordinances; (2) good personnel; (3) good equipment; and (4) enforcement of ordinances.

Good Ordinances—The effective operation of any Street Cleaning Department depends upon good City ordinances and their enforcement. One of the first prerequisites is a set of ordinances which are tailored to fit the present needs of your particular community, based on good common sense. The wording of these ordinances should be simple and direct so that they can be easily understood by the citizens who are governed by them.

Good Personnel — Good personnel is certainly essential to any street cleaning department. Just to say that anyone can do this work is wrong. A good mechanical sweeper operator or flusher operator is as important as a good superintendent, and care should be taken to see that the men selected are fitted for the particular job they are to perform.

Good Equipment —To me, one of the most important factors to be considered in the operation of this department is the equipment to be used. There are many new types of equipment for street cleaning and leaf collection on the market today. Everyone will agree that the mechanical type of street cleaning equipment is far superior, although it is still necessary to do a certain amount of hand cleaning where parking is too heavy for machines to work. Regardless of the type of equipment selected, however, the cleanliness of such equipment is of prime importance. Neglect of this phase of good maintenance will nullify much of what we may do to make for more efficient operation. Experience indicates that each piece of equipment in use should be washed daily at the completion of work. Thorough cleaning, preferably with steam, should be given weekly.

Enforcement of Ordinances — Proper enforcement of ordinances pertaining to street cleaning will help make the work more pleasant and more effective. In our city, we devote as much time to this phase of our work as we do to any other, for without enforcement of our ordinances we would be wandering around in the dark.

(*Continued on page* 131)

● **STREET flushing is one method used in Birmingham for keeping streets clean.**

Courtesy Alaskan Railroad

How a Water Supply was designed

This article, which describes the design of the proposed Fairbanks water system, is based on a paper presented at the Alaska Science Conference, held in Juneau, Alaska, last September. The paper was read by H. C. Westfall, Supervising Senior Engineer, R. W. Beck and Associates, Consulting Engineers of Seattle, acting for John R. Wallace. The material was sent to us by Donald H. Eyinck, City Manager of Fairbanks, who says: "To install a water system for a city which has grown from 5771 in 1950 to 7500 in 1953 would be difficult. But when the population increase is of the "explosion-type" resulting largely from defense installations, accompanied by the development of a fringe area population of 20,000, a sudden and immediate need is created. To compound the problem, conditions inherent to this area include a limited working season, great distance from sources of supply, high labor costs, intermittent permafrost and financing."

The author wishes to give full credit to Captain William B. Page of the Arctic Health Research Center, Public Health Service, for his personal assistance during the research stage of the design work and for his independent research prior to this project. Credit is also given to Lt. Col. K. E. Day of the Arctic Health Research Center and to Amos J. Alter of the Alaska Department of Health for their assistance and cooperation.

JOHN R. WALLACE, Jr.

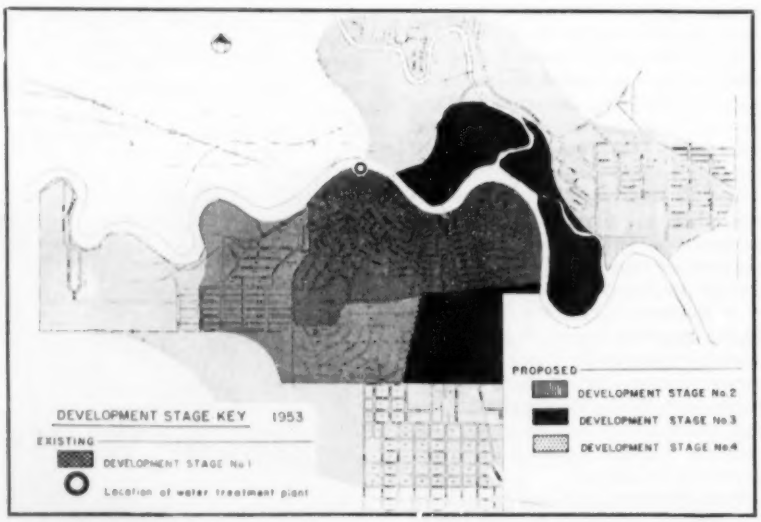
Principal Engineer

R. W. Beck & Assoc., Seattle, Wash.

DESIGNING the water distribution system for the City of Fairbanks, Alaska, presented problems not normally encountered in water system design. Fairbanks lies in the Tanana River Valley of the Central Plateau Region of Alaska, some 120 miles below the Arctic Circle. Winters are long and cold with a mean temperature ranging from 40° to —17°, with a lowest recorded temperature of —66°F.

Permanently frozen ground, or permafrost, is prevalent and in places is less than three feet below the surface. Seasonal frost penetrates to depths of as great as ten feet. These soil and climatic conditions result in a condition where no frost free depth is available in which to install a conventional type water system. This condition, plus the resulting installation and operational costs, were factors considered in selecting the type of water system which should be installed.

A 1 mgd treatment plant was recently constructed, but the existing distribution system is limited to a small area of the business district. This system is protected from freezing by means of steam tracers. Since the system is so small it was necessary virtually to disregard it and design a complete new distribution system. Four types of systems were considered in detail and the relative advantages and disadvantages of each were compared before select-



● **LAYOUT of Fairbanks, showing keys to stages of planned development.**

Photo from FPG

for a PERMAFROST AREA

ing the type to be used. The single main recirculating system provides the lowest estimated installation cost at $2,600,000 for the mains, service connections and necessary pumping facilities. Operating costs for power to circulate the water in the system is estimated at a maximum of $36,000 per year. The major disadvantages of the system are that it is entirely dependent upon circulation as a means of preventing freezing; and the pumping facilities are, in essence, the heart of the system and must be operated without interruption throughout the winter months.

The second type of system considered was the dual main recirculating system. The same disadvantages apply to the dual main system as applied for the single main system, namely the dependency upon circulation as a means of preventing freezing. This, plus a higher installation cost, estimated at $3,500,000, caused us to eliminate the dual main system.

The next type of system considered was the steam tracer system. The initial installation cost of this type of system was estimated at $4,760,000 of which approximately 40% would be required to install the steam tracer. However, because of the reliability and long standing acceptance of the steam tracer system, careful consideration was given to its use before being abandoned. One major disadvantage of this system is the quantity and cost of steam which would be required; and the present steam generating facilities could not satisfy this demand. Consequently, another source of steam would be required which would undoubtedly be in the form of a new steam generating plant, the cost of which is not included in the above estimate.

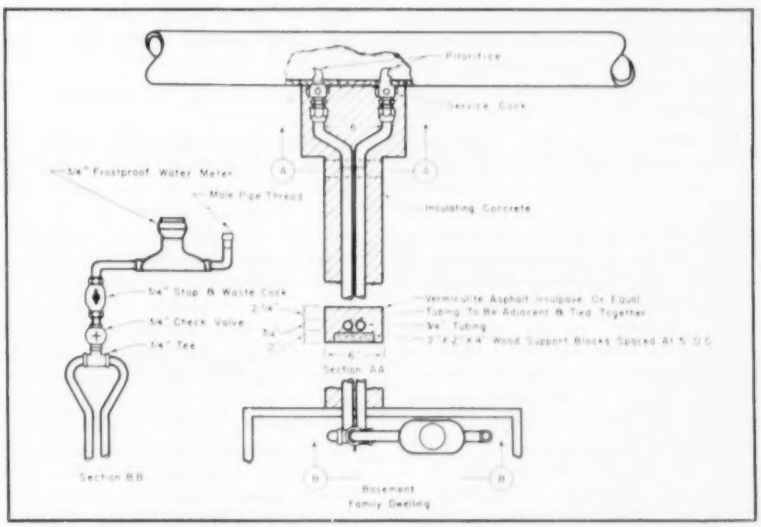
The fourth type of system which was considered was the use of utilidors. However, the initial costs for this type of installation are prohibitive when considering the quantities involved.

The Recirculating System

After an analysis of the advantages and disadvantages of the four types of systems, it was determined that the most feasible system which could be installed is the single main recirculating system.

The fundamental principle of the single main recirculating system is that by maintaining sufficient velocity of the water in the mains and service connections, sufficient heat cannot be dissipated from the water to cause freezing. The system does not, as many believe, defy the laws of thermodynamics and prevent freezing under any condition. Instead, it is based on fundamental engineering principles of heat transfer and the balance of flow of water throughout the system.

The water within the system contains a definite quantity of heat composed of specific heat and latent heat. Likewise, there is a definite transfer of heat from the water to the soil surrounding the pipe when the latter is at a temperature below that of the water. It is possible to remove all of the specific heat of the water above the freezing point and at least a portion of the latent heat of fusion before freezing in the



● **DETAIL of "pitorifice" to assure circulation of water in house services.**

mains will start. By maintaining sufficient velocities in the mains within the system the water will travel from the source of heat, throughout the distribution system, and back to the source of heat before sufficient heat is lost to cause freezing. As the water travels through the mains, the friction of the water in the pipe is transformed into heat and transmitted to the water. However, at velocities low enough to make such a system economically feasible, this friction heat is not sufficient to offset the loss of heat from the system. Consequently, it is necessary to add heat to the water at some point in the system. This heat is supplied to the water by means of warmed make-up water and by a heat exchanger both of which employs as a source of heat, the normally wasted condenser cooling water from the City's steam generating plant which is located adjacent to the water treatment plant.

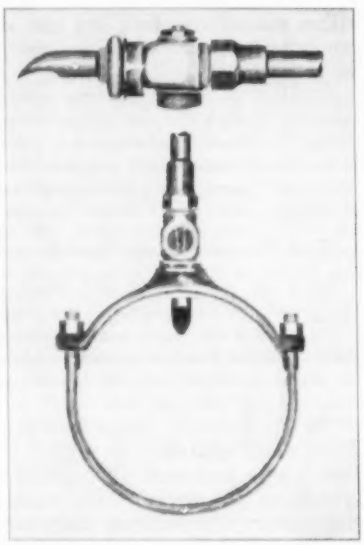
Since the theory of the single main recirculating system is based on the circulation of the water in the mains, versus the heat loss in the system, it is of primary importance that an accurate accounting of the heat losses within the system be made. The general problem is to calculate the heat loss per foot of pipe for the various size mains and service connections.

Test data obtained from the Arctic Health Research Center, U. S. Public Health Service, was used as a basis for determining the ground temperatures at various depths. From this data it was determined that the optimum depth for the water mains was 6 feet below the surface. At this depth the minimum ground temperatures to be encountered will be approximately 15°F and the average temperature during the winter months will be 27°F.

In order to determine the heat loss from the pipes, it was necessary to make several basic assumptions. First, and probably the most important of these, was in the determination of the thermal properties of the soil. Since the soil surrounding the pipe will be the greatest insulating medium for the water, the thermal conductivity of the soil is of prime importance in the calculations of heat losses. It was assumed that backfill will be a mixture of sand and silty loam with 5 to 10 percent moisture content. From data in a report on Thermal Properties of Soils by Miles S. Kersten, University of Minnesota, which covers extensive investigations on the thermal properties of soils including actual soil samples from the Fairbanks area, the thermal conductivity of the average soil under maximum conditions was taken at 12 Btu per hour per square foot per inch thickness per °F, and 9 Btu per hour per square foot per inch thickness per °F for average conditions.

In computing the quantity of heat loss from the wood stave pipes, the wall of the pipe and a layer of soil surrounding the pipe were considered as two concentric hollow cylinders of insulation and the heat losses were computed using standard formulas.

With this information and knowing the ground temperatures to be encountered, we determined that the most desirable velocity at which



● **HOW pitorifice is tapped into main for service connection.**

the water should be circulated is 3 feet per second.

In laying out a system which will serve adequately the area to be supplied now; and, at the same time make adequate provisions for expansion, a main, or primary loop system was developed using pipe sizes sufficient to allow for system expansion. A series of secondary loops was then developed to fill the areas within the primary loop. In developing these loops it was necessary to conceive an integrated system whereby the flow would be from a high pressure point to a low pressure point. However, it is desirable in any water system to maintain, as near as possible, a uniform pressure throughout the system. In order to do this, it was necessary to incorporate three booster pump stations into the system so that the pressures could be maintained within the desired limits. Thus, there were created three points in the system between which the water circulated. In other words, the water will start from one booster pump and travel through the loops to a lower pressure on the suction side of the next pumping station where the pressure will again be boosted and so on around the system.

Make-up water for the system will be independent of the circulation pumps, being supplied by a group of pressure controlled pumps located in the water treatment plant.

The determination of the flow characteristics of a complex system such as the Fairbanks distribution system would not have been economically possible without the use of the McIlroy Pipe Line Network Flow Analyzer. This is especially true because of the wide variety of conditions which had to be considered, and the accuracy required in the design of the system.

Because of the limited size of the analyzer it was necessary to analyze the system in parts. Each loop or system was analyzed under various conditions of loading and the pipe sizes adjusted until the desired balance of flow was obtained. After the complete system was analyzed by parts, these individual loops were substituted by an equivalent resistance and the system analyzed as a unit. In this way it was possible to determine the characteristics of each individual pipe and the characteristics of the system as a whole under all conditions of loading.

Three conditions of loading were considered in making the analysis. First, the minimum quantity required to maintain the desired velocity of three feet per second. Second, the quantities which would be required to satisfy the maximum hourly demands of the system, plus the quantity required to maintain the circulation. And third, the fire load which can be expected on the system in addition to the average hourly demand and the circulation flow. The head loss and flow characteristics of the system were determined for these three conditions and adjustments in pipe sizes were made until the desired velocities were obtained in all of the pipes under all three conditions.

One of the major problems in the design of the single main system was the development of the dual main house service connection and the insert into the mains which

(*Continued on page* 133)

Courtesy Standard Oil Company of California Bulletin

● **PAVED SHOULDERS added to inside of sharp curve on an existing Pacific coast highway thus increasing its width and safety.**

How to make Old Roads fit for Today's Traffic

by George E. Martin, Highway Consultant

Entirely new pavements have not been built generally in the past several years except for a few special projects. The demand has been there—traffic has increased tremendously both in volume and weight—but enough money to build entirely new roads

has not been available. Few highway organizations are able to buy a brand new suit. They have to patch the pants, let out the waistline, lengthen the sleeves and make it do. To accomplish this, many new and ingenious machines and methods have been devised, new materials created and new uses found for old ones. All phases of the highway industry are working together to make the best use of existing highway facilities and improve them to meet adequately the demands of present day highway users.

We now bring this accumulated experience together so that it is available for everybody. There are several ways you can approach the problem. These include minor re-locations; strengthening foundations; widening; and improving surfaces. All are included in this artcile.

Re-location

Highway re-location has played only a minor role in the modernization of existing pavements. Some curves are flattened to give better sight distance, and usually the pavement is widened at the same time. As a general rule, no extensive surveys or plans are required on work of this kind. The work is marked on existing plans and staked out by the engineers in the field.

Re-locations to reduce existing grades are generally more elaborate than those to reduce excessive curvature. Make a preliminary survey of some sort and at least simple plans. However, you will find even these location changes are minor in comparison with an entire modernization project and no elaborate preliminary preparations are necessary.

New construction is used on re-located sections and should meet the standards of the organization doing the work. In other words, you should build a re-located section like a new highway except it should match the rehabilitated old road, where it is a part of or joins with the rebuilt existing highway. These sections are normally short and present no new problems to the highway official conversant with the design and construction of new highways of the type chosen.

Photo Bulletin Std. Oil Co. Cal.

● **BITUMINOUS MATERIAL being sprayed on aggregate for road mix.**

Strengthening Support for Rigid Pavements

Causes: Trouble under rigid pavements is usually indicated by the phenomenon known as "pumping". The pavement slab deflects under heavy traffic at joints, cracks and along pavement edges and this action forces water and soil out from under the pavement. As a result voids and open spaces are left, and the support of the slab is reduced. Eventually the pavement breaks and failure results.

Several conditions must be present at the same time in order to produce a pumping slab. The subgrade soils must be of such a nature that when saturated they will move up through openings in the pavement; that is, these soils must contain a predominance of silt and clay. If the soil contains more than 55% of sand and gravel, retained on the No. 270 sieve, pumping is not likely to occur. Free water must be present in the area under the slab and adjacent to a joint, crack or edge of the pavement. The free water is mainly surface water which enters through cracks, joints and the edges of the pavement, but may be from water-bearing strata, high water table, or ice melting in the soil. A large number of heavy vehicles passing over the road is also necessary to produce pumping. Trucks have increased in size and numbers in the past few years and may cause trouble even though they are within the legal limit of weight. Unfortunately there has been a tendency in some states to increase the load limit beyond that for which the roads were designed. Also there always are a few who load their trucks above the legal limit, hoping to get away with it.

A visual inspection of the pavement will show you several clues pointing to possible pumping difficulty. Excessive spalling along the centerline near a crack or joint is one of the first indications. Ejection of water from joints and cracks as traffic passes over the pavement is another, and this is often accompanied by discoloration of the pavement near joints and cracks. A "mudboil" may appear in the shoulder at the edge of the pavement. Usually the next thing that happens will be breakage of the pavement, either as an inside corner break, or as a transverse crack across one traffic lane a short distance ahead of a joint or previously existing transverse crack. Once started, pumping may become active and, given the proper conditions, it will advance rapidly along a traffic lane in the direction of traffic flow. The sooner you start the strengthening process, the easier it will be to accomplish the desired results. Voids are smaller in the early stages and thus more easily filled. Also early action will prevent extensive damage to the pavement.

What To Do: The best method for strengthening the support of rigid pavements is to force a suitable material or mixture of materials under the slab. This displaces the water and fills the voids between the subgrade and slab with materials which will not pump and are not affected by water. Slabs that have settled may also be brought back to the right elevation by the same procedure. Soil or similar replacing material is forced under the pavement by means of a mud-jack. When you use bituminous material it is pumped through the pavement to fill the voids under the slab.

Mud-Jacking

Materials: Soil is the basic material for most mud-jacking operations and may be modified by adding cement, hydrated line, fly ash, calcium chloride and similar materials. In practice you mix modified soil with water to form a slurry of about the consistency of thick cream. A small amount of bituminous material may be added to the mixture. Mix the materials to form the slurry thoroughly together, place in the mud-jack and force under pressure through a hole drilled in the pavement slab.

Not just any soil will do, although most soils can be modified by admixtures to give the desired qualities. The soil must mix easily with water to form the slurry. That means that it must not contain too much clay since clay will not mix easily with water. It should not contain an excessive amount of organic material as the organic material may react with the cement commonly used as an admixture and reduce the efficiency of the cement. Soils that contain a large amount of sand are not satisfactory since they produce a harsh mixture that is difficult to pump and does not readily penetrate the smaller voids under the pavement.

A good mud-jacking soil consists of fine sand, 1-1 passing No. 40 sieve—and silt and clay in such proportions that the paste formed from the silt and clay will coat the sand particles to eliminate detrimental harshness in the mixture. Fig. 1 is a gradation curve for a satisfactory soil. A soil that fits this curve is found only in rare cases but the curve serves as a guide in selecting the best available soil. It also points out what is lacking in the particular soil and makes it possible to find out the kind and amount of admixture to use. If the soil is deficient in fine material you can correct it by adding hydrated lime which tends to fatten the mixture, act as a lubricant, and maintain the sand grains in suspension. On the other hand a soil with too much fine material may be improved by adding fine sand which makes an easier pumping and stronger mixture. Probably some trial mixtures will be necessary to choose the best one.

The mud that is to be forced under the pavement must not shrink too much. This is very important because voids of irregular depth are common under most pavements. Some of them vary from an inch or so to several inches in a very short distance. If a material with a high rate of shrinkage is used in a case of this kind, the slab will still have uneven support after mud-jacking, when the shrinkage takes place. To reduce shrinkage and to provide additional strength, add Portland cement to the soil in making the slurry.

Laboratory Tests

If laboratory soil tests are available they can be of value in selecting the proper mixture. You can use the standard shrinkage limit test to determine shrinkage characteristics. Hardening may be measured by observing the time of set and compressive strength. Twenty-four hours is the maximum time of set you should permit for satisfactory mixes. Compressive strength tests are usually made at ages of 24 hours and four days. Soil mixtures do not shrink appreciably when their shrinkage limits are equal to, or more than, the moisture content required to give necessary fluidity. Soils having a volumetric shrinkage less than 10 percent are satisfactory.

The liquid limit test is of general value to indicate the comparative fluidity of different mixtures. A liquid limit approximately equal to the clay content indicates the presence of inactive fine particles that form pastes with relatively small amounts of water, which is a distinct advantage. Where the liquid

Photo courtsey Barber-Greene Co.

● **TRAVELING PLANT mixing aggregate and binder for widening.**

limit exceeds the clay content it indicates the presence of undesirable glue colloids. Soils that have liquid limits in excess of 35 are usually hard to mix with water, and if you don't mix them enough they may cause jamming of the pump. Within the range of mixtures having the desired fluidity the difference in harshness has little significance. Mixtures not sufficiently fluid tend to jam in the pump and are not well distributed under the slab.

If laboratory tests are not available, simple field tests will be of value. You can judge shrinkage by mixing a properly proportioned batch of the materials to the desired consistency and molding in the top of an ice cream carton or similar flat container and drying in the sun or other available source of heat. The absence of shrinkage or the occurrence of a very small amount indicates a satisfactory mixture. Appreciable shrinkage indicates the need for a change in the soil, (lower clay and organic contents) or the use of an additional amount of admixture. Judge hardening by means of similar samples buried in the shoulder at the edge of the slab for 24 hours.

Having selected the soil and admixtures you are now ready to mix the material with water to form the slurry or mud. It usually has the consistency of thick cream, which is the proper fluidity to fill most of the voids under the pavement. Various mixtures have been used and two of the commonly used ones are given in Table 1. The bituminous material (generally asphalt cutback SC-2, MC-1 or RC-3) is added to waterproof the filling material.

The amount of water used depends upon the moisture content of the soil, the nature and amount of the admixture used and the consistency desired. Usually the amount of water required is approximately one-half the loose volume of the other materials used.

The final mixture must have low shrinkage but should not be hard and brittle when dry. The mix should be sufficiently fluid to spread rapidly under the pavement and flow into small cavities. A fairly stiff mixture is used to fill the large voids under the slab or to raise it, and a thinner mixture to fill the smaller voids.

Table I—Typical Mud-Jack Slurry Mixtures

	Percent by Volume		
Mixture	***Soil***	***Cement***	***Bitumen***
A	60-84	16-40	0
B	77	16	7

Working Procedure: Equipment needed for the mudjacking operation will be:

> Mud-Jack with mixer; 1½ inch bits; air compressor; 45# pneumatic jack hammer; water tank and pump; trucks; tapered steel nozzle; tapered wooden pegs; and square and round point shovels

The first operation is to drill the proper holes through the pavement. A hole 1½ inches in diameter is commonly used. The equipment used in drilling the holes should not strike too heavy a blow as there is danger of breaking a large chunk off the lower side of the slab as the drill goes through. Drill a hole near the intersection of the transverse joint or crack and the center joint to expel water and fill the voids under the slab. Space the holes 12 inches from the centerline and beyond the transverse joint or crack in the direction of traffic. When treating a transverse joint drill two holes in the diagonal corners. When treating a transverse crack, one hole is usually sufficient for the entire width of a two-lane slab. If outside holes are needed to fill voids or raise the slab back to grade, place the holes 30 inches from the edge of the pavement and 30 inches beyond the crack or joint in the direction of traffic. Location of holes in a two-lane pavement are shown in Fig. 2. In treating a four corner failure, as shown in Fig. 3, one hole is usually enough to fill the voids if the slab is tight. The suggested location of holes in a multiple lane pavement is shown in Fig. 4.

These suggestions for the location of holes are only general and the operator of the equipment must learn to space the holes according to the way he must fill the voids, and lift or tilt the slab if necessary.

After the holes are bored the void-filling operations begin. If the mudjack does not have a mixing chamber the slurry can be made in a cement concrete or bituminous concrete mixer. Except where the material is free from hard lumps and stone, screen it through a ½ or ⅝ inch mesh screen before it is mixed with the water. This not only makes it easier to mix and pump but when you use material containing any appreciable amount of stone the narrow openings between the slab and the sub-grade may be clogged so the voids cannot be filled. Sometimes the hole through which the material is forced is entirely clogged by stones thus stopping the pump.

Cleaning the Void

The first step in the void-filling operation is to force as much water

● THREE LAYERS of a modern highway. At left, the stabilized aggregate base course, next the asphaltic concrete leveling course and surfacing course at right.

Courtesy Standard Oil Company of California Bulletin

as possible from under the slab by compressed air. This is necessary to avoid diluting the soil mixture and to insure filling the void spaces. To permit the escape of the water, vent each transverse joint or crack to the outside edge of the pavement by digging away the shoulder material. It may be necessary also to strip short sections of the filler from the expansion joint to provide means for the escape of the water.

After the water has been forced out, mud is pumped into the voids until you see it in the cracks and in the vents at the edge of the pavement, or until there is indication of raising of the pavement. The operator of the mud-jack nozzle can detect the slightest raise by placing his fingers in the joint or crack. Another method is to place a thick mud pat across the joint or crack. The mud pat shows a slight hair crack when the pavement begins to move. Complete filling of all voids is very important.

In raising slabs, continue pumping, moving from hole to hole and lifting the slab only a small amount each time until the desired elevation is attained. Too much leakage of mud through the joints and cracks can be stopped by tamping a mixture of dry soil and cement into them to retain sufficient pressure to raise the pavement.

When the slab to be raised is heated by the sun, it is best to do the work in the morning before expansion and excessive end pressures develop. You will find uneven joints and cracks are much more easily smoothed out when cool than when they have been warmed up on a hot day.

When the work is completed and the nozzle removed plug the hole temporarily with a tapered wooden plug driven into the hole. The clean-up man pulls the plugs and tamps a dry mixture of one-half soil and one-half cement into the hole. Moisture from the slurry will seep through the soil-cement plug and cause it to set.

Under-Sealing

Material: Bituminous material pumped beneath the slab is effective in correcting the pumping of rigid pavements. When the voids under the pavement are large and deep, you can save money by filling most of the voids with a fairly stiff soil and water slurry before starting the bituminous filling.

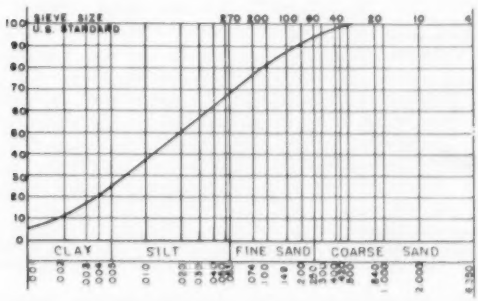
Bituminous material, used for correcting pumping, effectively seals the area under the pavement and retards the entrance of surface water. Further, water from the subgrade does not appreciably affect bituminous materials. A bituminous material is easily pumped because its fluidity depends only upon its temperature.

Most of the work has been done with oxidized asphalt with penetration ranges from 10 to 45 and softening points ranging from 165 to 225 degrees F., the harder material being used in the warmer climate. However, asphalt emulsions RS-1 and RS-2 have recently been used successfully.

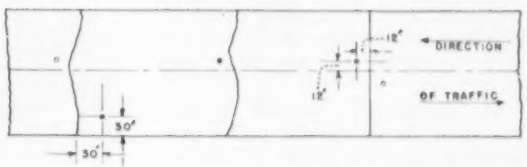
Detailed asphalt specifications are given in Table 2. A special tar pitch developed as a filler for block pavements has been used to a limited extent.

Working Procedure: Again the first operation is to bore holes 1½ inches in diameter through the pavement slab. In general, for minor cavities or where there is no settlement of the slab, drill holes 12 to 18 inches in the direction of traffic from the crack or joint. Where settlement has occurred, drill the holes 24 to 36 inches back from the crack or joint.

In addition drill single holes, spaced at intervals from 10 to 20 feet, alternated across the center line of the pavement, and placed about 3 feet from the center line. Also sound the pavement with an iron bar, and drill holes where the sounding indicates a hollowness. Do not drill holes more than one

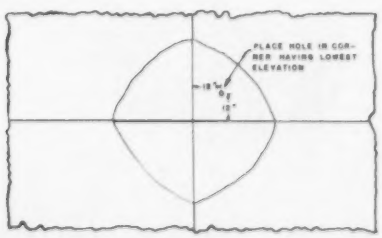


● **Fig. 1. RECOMMENDED gradation of soil for slurry with water to be forced underneath rigid pavement.**

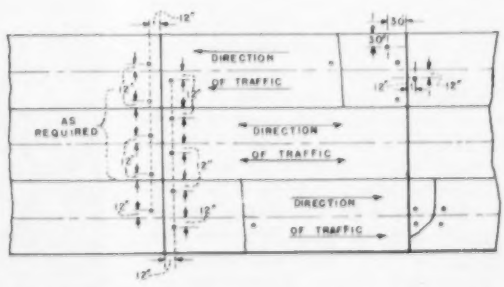


Figs. 1 to 4 Courtesy Koehring Co.

● **Fig. 2. LOCATION of holes bored in two-lane pavement through which material is forced under slabs.**



● **Fig. 3. FOUR corner failure in rigid pavement. One hole is usually sufficient in correcting difficulty.**



● **Fig. 4. PATTERN of drill holes in four-lane road. Note relation of holes to cracks and traffic direction.**

Table 2—Specifications for Asphalt Cements for Undersealing Rigid Pavements

General requirements—The asphalt used shall be prepared by the refining of petroleum. It shall be uniform in character, free from water, and shall not foam when heated to 350° F.

Softening Point (Ring and Ball) °F.	**160-180**	**180-200**
Flash Point (Cleveland Open Cup) °F.	**425+**	**425+**
Penetration of Original Sample		
At 32° F., 200 g., 1 min.	**15+**	**10+**
At 77° F., 100 g., 5 sec.	**25-40**	**15-30**
At 115° F., 50 g., 5 sec.	**90—**	**90—**
Loss of Heating at 325° F., 5 hrs., %	**1.0—**	**0.5—**
Penetration after Loss on Heating, % of Original	**70+**	**70+**
Ductility at 77° F., in cms.	**3+**	**2+**
Solubility in Carbon Tetrachloride, %	**99.0+**	**99.0+**

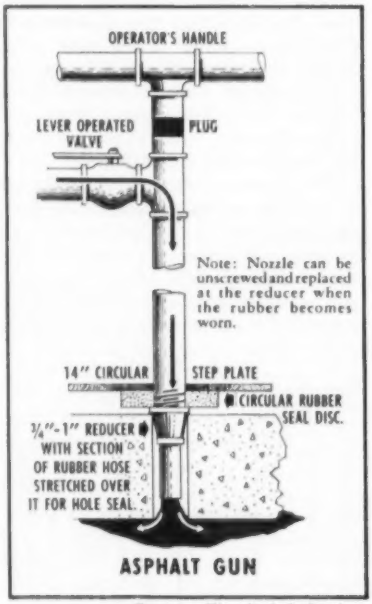
day in advance of pumping operations because open holes foster mud-pumping in rainy weather.

The equipment needed for undersealing will be: Air compressor; jack hammer; 1½ inch drills; pressure distributor and accessories; 3-gal. water sprinkler can; and tapered cylindrical soft wood plugs with maximum diameter ⅛ inch larger than the holes.

Any distributor having a capacity of 500 gallons or more and equipped with a rotary positive pressure type pump and full circulating asphalt delivery line can be used satisfactorily. In most under-sealing operations distributors are equipped with two sets of pumping hoses of appropriate lengths so that two holes may be treated with asphalt at one time.

To introduce the asphalt through the hole to the voids under the pavement several types of nozzles are available. A simple one is the asphalt gun shown in Fig. 5. On this device the lower end consists of a ¾-inch nipple and a ¾ to 1-inch reducer, with a piece of rubber hose stretched over the reducer. This section can be removed and replaced when the rubber becomes worn, during the pumping applications, thus insuring a tight connection at the hole. Commercial nozzles are also available from bituminous distributor manufacturers. Normally, full circulating lines connect the nozzle to the distributor, with a by-pass valve located at the applicator, so when pumping is stopped at each hole a full circulation of hot asphalt will be had between the applicator and the distributor.

Dig a short trench, slightly deeper than the pavement thickness, in the shoulder at each end of the joint or crack to be pumped. This serves as a well for the mud and water blown from under the slab and also for observation during pumping operations. Water and mud are blown out by forcing compressed air into the hole, using the type of nozzle specified for use with the distributor. In especially wet locations it is desirable to blow the mud and water out immediately before injecting the asphalt; but in dry areas this operation may be carried out considerably in advance of pumping asphalt under the slab.


OPERATOR'S HANDLE
LEVER OPERATED VALVE
PLUG
Note: Nozzle can be unscrewed and replaced at the reducer when the rubber becomes worn.
14" CIRCULAR STEP PLATE
CIRCULAR RUBBER SEAL DISC.
¾"-1" REDUCER WITH SECTION OF RUBBER HOSE STRETCHED OVER IT FOR HOLE SEAL
ASPHALT GUN

Courtesy The Asphalt Institute

● **UNDER-SEALING gun, Fig. 5.**

Heat asphalt, except the emulsions, to about 400 degrees F for application and pump through the hole in the slab under a pressure of from 30 to 40 pounds per square inch. Sprinkle some water around the hole before asphalt pumping is started so that any spillage may be removed easily.

Continue pumping until the asphalt appears at the observation trench or until the slab starts to rise. If the slab starts to rise before asphalt exudes at the edge of the pavement, or if asphalt appears at one edge of the pavement and not the other, it may be desirable to drill another hole and attempt to force in more asphalt. During the pumping operation, if asphalt begins to leak out onto the pavement surface through a joint or crack, the pumping should be stopped, the asphalt chilled with water, and pumping then resumed. If leakage still continues it can usually be stopped by placing over the leak stiff clay or mud held in position by a man or a suitable weight. This latter procedure is used in the case of emulsions since they do not solidify by heat loss. When sufficient asphalt has been pumped in, shut off the asphalt but allow the nozzle to remain in the hole for about

Courtesy Littleford Bros.

● **FORCING bituminous material beneath rigid pavement for under-sealing.**

thirty seconds before it is withdrawn. Immediately upon removal of the nozzle drive the soft wood plug into the hole flush with the pavement and scrape off the spillage.

When hot asphalt is used there is some danger of injury to the workmen. They should wear heavy clothes, gloves and a welder's mask.

With minor exceptions you can use this sealing procedure to raise slabs. Drill holes are usually spaced 18 to 24 inches from the crack or joint and mid-way between the center joint and the edge of the pavement. If the slab starts to rise where it does not need raising place a loaded truck over that spot to hold it down. Some operators prefer to raise the slabs up mechanically with hydraulic jacks to the desired elevation before pumping asphalt under them.

Courtesy Athey Products Corp.

● **BREAKING and loading old bituminous pavement for use on reconstruction.**

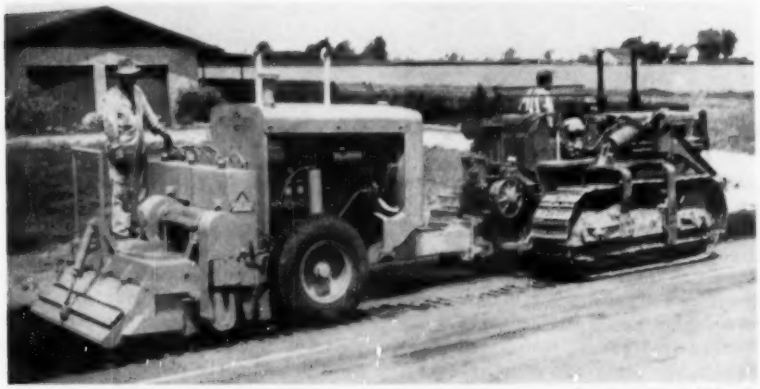
Strengthening Support for Flexible Pavements

Causes: Flexible pavements that have weak support first show the characteristic map cracking on the surface and then begin to push out of shape under traffic. In the final stage holes appear and the pavement breaks and disintegrates.

The causes may be poor sub-grade material, insufficient thickness of foundation or base, poor drainage or a combination of all three. Excessive loads above the design weight may also be a contributing factor. In some localities heavy traffic during a thaw or spring "break-up" causes trouble.

Courtesy Hyster Company

● **SPECIAL roller breaking and consolidating old bituminous surface material.**



Courtesy Wood Mfg. Co.

● **MACHINE which breaks and mixes old bituminous surface for reconstruction.**

What To Do: Up to-date nobody has devised a method of strengthening the support of a flexible pavement without disturbing the top, as can be done with rigid pavements. However, building an additional penetration macadam or bituminous concrete layer on the top may be the answer, and the remedy can thus be combined with obtaining a new surface.

In cases where you feel this will not be adequate the best solution is to rip up the old pavement and base; correct the drainage and strengthen the sub-grade if necessary; add new material; re-mix; and lay the pavement back down. This provides a strengthened base to support the new surface.

You can accomplish the tearing up operation with a scarifier and a blade grader or bulldozer working together. Further breaking and mixing can also be done with the same equipment. Several special machines have been developed to facilitate the breaking and mixing operations. The time to add new aggregate is usually during the mixing. In general the thickness of the new base must be determined on the basis of experience on other jobs in the vicinity under similar loading conditions. If there is any doubt it is good policy to increase the thickness. After the road is torn up it does not cost much to add aggregate and thus make the foundation stronger.

Now you lay down the material in layers of four to six inches thickness, with each layer thoroughly consolidated. Special rollers have been developed that facilitate the

breaking and also do the consolidating. Both rubber tire and steel tired conventional rollers are also useful compacting tools.

Prior to placing the new surface give the re-constructed base a prime coat of about one quarter gallon of bituminous material per square yard. Various materials such as tar RT-3, asphalt MC-2, or RC-3 and emulsion RS-1 are used. Generally no covering material is necessary and you can open the base to traffic for a limited time before the application of the wearing surface.

Widening

In the early days, everyone considered a sixteen foot road to be ample for two-way traffic and many pavements were built of that width. Cars and trucks are wider and faster now so a wider roadway is usually required in a modernization program. Traffic lanes now are generally at least 12 feet wide and some engineers build them even wider.

Regardless of the type of existing pavement the first widening operation is to prepare a trench to receive the new material. When this was done by hand or even with a blade grader it was an expensive and time consuming operation. However today there are trenching machines that make the job easy. These machines excavate the trench and deposit the material on the berm away from the road or load it directly into trucks for hauling away. Some special grader blades have been devised to cut the trench to exact width and depth.

The depth of the trench depends upon local conditions and the traffic expected on the road. In general it is not less than six inches and may be twelve inches or more.

The Foundation

Numerous materials and types are used to fill the trench and provide the widened foundation. Standard cement concrete may be used although you generally use it in connection with concrete resurfacing and pour it at the same time you place the new concrete wearing course.

Soil-cement can be prepared and tamped or rolled in place. Mix the selected soil with about ten percent of cement and enough water to produce a damp, but not wet, mix. Cover the bottom of the trench with an insulating layer of screenings, sand or similar granular material. This layer should be about three inches thick and the material composing it should be thoroughly consolidated in place by means of a trench roller. To insure proper consolidation make the insulating material damp but not wet. Place the soil-cement in layers about three inches thick. Spread it by means of rakes or shovels and then roll in place. Score the top of each layer with a rake or similar tool so that the next layer will bond with that already placed. Soil-cement should be placed and compacted within two hours after mixing. Allow it to cure for 48 hours under paper, wet bags or wet earth.

Probably most widening projects make use of broken stone, slag or gravel for the filling material. It is good practice to start with an insulating course as just described. Above this, place the aggregate in layers about four inches thick with each layer rolled in place with a trench roller. Water assists in obtaining proper consolidation, but do not skimp on the rolling.

Courtesy Ulrich Products Corp.

● **SMALL BLADE attached to motor grader for cutting pavement widening trench.**

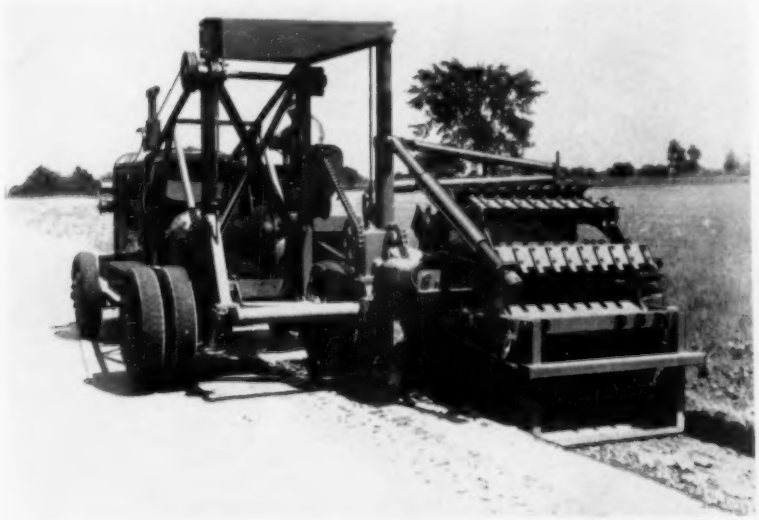
Courtesy Galion Iron Works & Mfg. Co.

● **TRENCH ROLLER consolidating aggregate in trench alongside the pavement.**

Filling the Trench

Bituminous penetration macadam may be used to fill all or part of the depth of the widening trench. The aggregate, which may be broken stone or slag, should have a top size of two to three inches and should be nearly a one-sized material, rather than graded from fine to coarse, if you use a hot binder. Since

the strength of the base depends upon the interlocking of the aggregate particles, use a crushed or at least an angular material. Place the aggregate in layers of about four inches loose depth. Thoroughly roll the bottom layer with a trench roller. Heat bituminous binder, 85 to 100 penetration asphalt cement or road tar RT-12, and pour it into the voids of the consolidated aggregate at the rate of one half gallon per square yard per inch of depth. The temperatures will be approximately 350 degrees F. for asphalt and 250 degrees F. for tar. If you use an asphalt emulsion binder, RS-1, the aggregate should be graded from fine to coarse partially to fill the voids. This is necessary to prevent the asphalt emulsion from going to the bottom of the layer. Under normal conditions, the asphalt emulsion need not be heated. After the first coat of bituminous material has been poured fill the surface voids with clean stone or slag chips, or pea gravel, swept and rolled in place with the trench roller. More than one layer of the bituminous macadam may be used.



Courtesy Gar Wood Industries, Inc.

● **SPECIAL excavator digging trench along existing pavement for widening.**

Courtesy All Purpose Spreader Co.

● **MECHANICAL spreader being used to distribute aggregate in widening trench.**

You also may use bituminous concrete for all or part of the depth of the widening trench. The aggregate will have a top size of about two inches and should be bound with 4 to 6 percent of 85 to 100 penetration asphalt cement. The asphaltic concrete is made in a central mixing plant and hauled to the job by truck. You can also use one of the new small plants for producing patching mixtures or one of the traveling mixing plants. Spread the bituminous concrete in the trench in layers to give a consolidated thickness of about three inches. The spreading is done by means of a special spreading machine that carries the material to the trench and spreads it evenly. Consolidate it with the trench roller.

Many combinations of materials may be used in filling the trench. Usually the untreated layers like stone, slag or gravel will be in the bottom of the trench with soil-cement and various bituminous types forming the top one or two layers. The main requirements are to be sure to have sufficient depth and to have each layer thoroughly consolidated. The widening, except when you use cement concrete is finished even with the top of the existing pavement ready to be covered with the new wearing course.

Using Existing Materials

In many cases the existing shoulder consists of gravel or similar aggregate that can be mixed with bituminous material and consolidated without the necessity of excavating a trench, removing the existing material, and replacing with new material. The bituminous material used may be asphalt cut-back MC-3, asphalt emulsion MS-1, or road tar RT-6. Approximately 5 percent by weight will be needed to bind the aggregate together. Spray the bituminous material from a distributor on the existing shoulder and mix by means of a blade grader or one of the traveling mixing machines. The bituminous material may also be sprayed into the mixing machine to coat the aggregate.

In some areas existing soil shoulders may be stabilized by mixing with cement or bituminous material and used for widening. You must cover this type of widening with a weather and traffic resisting surface very soon after it is built.

Center Dividers

When the first four lane pavements were built everyone thought that they were the answer to traffic congestion. They were built without any center dividing strip between the opposing lines of traffic and the accident rate went up as soon as traffic reached anywhere near the capacity of the road. Head-on collisions and traffic delays were common. The roads were there and

had cost a lot of money so the question was, "What shall we do next?"

One state attempted the solution by moving the pavement slab sideways to provide a space between the two center lanes. Only a few projects were done in that manner. Another solution is to widen the existing pavement and place pre-cast concrete islands on the center line to provide a dividing strip. Still another highway department builds a concrete wall on the line between the two lanes. The wall is about 18 inches high and curved to deflect cars which come in contact with it. It is advisable to widen the pavement by somewhat more than the space occupied by the wall since cars tend to stay away from the wall. Steel dividers similar to guard rails have also been used.

In the newer multiple lane pavements the lanes carrying traffic in opposite directions are separated by landscaped strips of considerable width. However, there are many older pavements that need separators or dividers to make them safe.

Surface Improvement

Rigid Pavements

We are now at the point where defective support has been corrected and you must decide if a new wearing surface is needed and what type of wearing surface to use.

If the old pavement is still in reasonably good condition it may be possible to use it for a few years without a new top. But keep it under close observation so that a new wearing surface can be added as soon as it shows signs of distress.

Various types of wearing surfaces are used but the major portion of the mileage built is bituminous concrete or cement concrete.

Bituminous Concrete: It is assumed the pavement has been strengthened and widened where necessary and is now ready for you to apply the new bituminous concrete wearing surface.

Clean the cracks and joints in the old concrete of all loose material and fill the openings with fine graded bituminous concrete, tamped or rolled in place. Remove any bituminous patches that show an excess of bituminous material. If this is not done the bitumen may move up through the bituminous concrete layer and cause a fat spot. Heating or burning is sometimes necessary to aid the removal of the old patching material.

One problem in connection with a resurfacing project of this kind is to find some method to prevent existing cracks and joints in the old pavement from coming up through the new top. Various methods have been used. The cracks and joints have been covered with building paper or steel mesh reinforcement. These methods are still more or less experimental. Some engineers place a layer of bituminous penetration macadam on the top of the old pavement on the theory that the penetration macadam will absorb some movement and not transmit it to the top. Apparently this has been quite successful. Other engineers go even further and place a layer of gravel or macadam from six to nine inches thick over the old rigid pavement and build the new pavement on top of this layer. In some extreme cases they break the concrete into fairly small pieces before they place the gravel or macadam layer. When the bituminous concrete is placed directly on the old cement concrete pavement some engineers use a somewhat open binder course to reduce the effect of cracks and joints. Still others add rubber to the asphalt binder to make the pavement more flexible in order to reduce the amount of cracking in the bituminous concrete surface.

Courtesy Portland Cement Assn.

● **CEMENT CONCRETE** for resurfacing is being spread over the old pavement prepared for a base. Note the transverse jointing steel in place.

The bituminous concrete wearing course should be from three to five inches thick depending upon the condition of the old pavement and type and amount of traffic expected on the new surface. Place the bituminous concrete in two or more layers. Usually the bottom or binder course will be of larger stone and somewhat more open than the top or wearing course. Use the standard specifications of the organization doing the work to control the preparation of the bituminous concrete.

Prior to placing the binder course prime the surface of the old pavement by applying about 0.15 gallon of asphalt cut-back RC-1 or asphalt emulsion RS-1, per square yard.

The road is now ready for spreading bituminous concrete with mechanical spreading machines. Use standard spreading procedure and consolidating effort to build the new wearing surface. It can be constructed without detouring traffic if necessary and opened to traffic as soon as it has been rolled and cooled.

Cement Concrete: When the old pavement is to be resurfaced with cement concrete you must determine several factors before the work is started. They are: 1.—Thickness of the resurfacing; 2.—Proportions of the new concrete; 3.—Whether to use reinforcement, and if it is to be used, the type, amount and location; 4.—Type, location and spacing of joints; 5.—Whether to bond the old and new slabs together or not.

The thickness of the new slab usually runs from 3 to 7 inches depending upon the condition of the old road and the weight of the traffic you expect.

Use the same porportions the organization doing the work uses for new concrete pavement. The proportions and type of aggregate need not match that of the existing pavement. Maximum size of the aggregate used must not be greater than one-third the thickness of the resurfacing slab.

Plain concrete is all right for resurfacing over old pavements that do not show abnormal structural breakage or cracking. When the existing pavement is in bad condition you will find it pays to use reinforcement in the resurfacing slab. Steel mesh weighing from 50 to 60 pounds per 100 square feet, or its equivalent in small diameter bars is usually satisfactory. The type and location of reinforcing steel and the location of joints in the resurfacing layer are very important factors in the success of the work and will be discussed in detail.

For thin concrete resurfacing, small reinforcing members are essential since large ones reduce the cross-sectional area of the slab to the point where its tensile strength is impaired. Don't extend reinforcement across transverse joints. Transverse joints should always be used in reinforced slabs. Otherwise the tensile stresses carried across joints in the old pavement by the steel tend to cause cracks.

Forming Joints

Include both longitudinal and transverse joints in the design of the resurfacing slab. If the concrete resurfacing is carried continuously over transverse and longitudinal expansion joints, cracks in the resurfacing will form above the joints. Normal cracks ordinarily are not reproduced in the resurfacing. Wide, open cracks in the old pavement however function like expansion joints and are likely to come through the new top.

Longitudinal joints coincide with those in the original pavement. All longitudinal construction joints should be of the tongue-and-groove type. If two or more lanes are built at the same time make the center joint the dummy groove type. If there are no longitudinal expansion joints in the existing pavement, don't use any in the replacement.

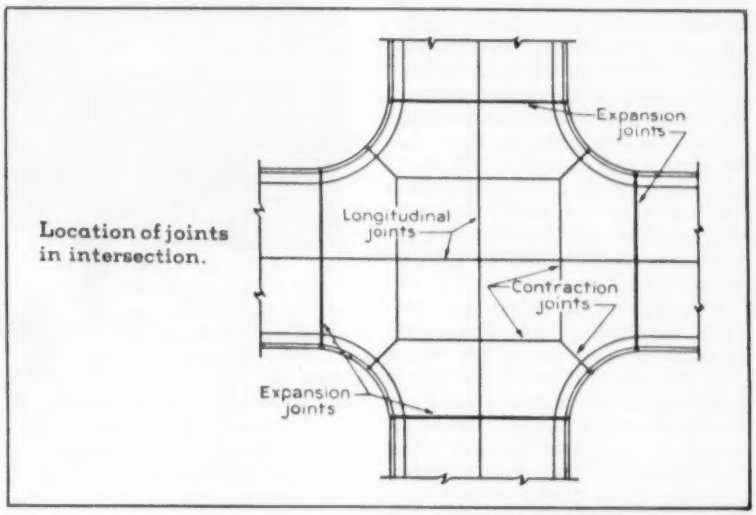
Install transverse joints at spacings that divide the pavement into slab lengths that control cracking. Cracking is influenced by the type and size of the coarse aggregate used and by the condition of the old pavement. Slab lengths usually should not be longer than 20 feet.

When you use transverse expansion joints, install them directly over the expansion joints in the existing pavement, but you don't need them over all expansion joints in the old pavement. Use them at intervals of not less than 120 feet. General practice is to place expansion joints at 400 to 600 ft. intervals in the resurfacing.

For city streets, place expansion joints at the property line on each side of the intersections for blocks of 600 ft. or less. For blocks of greater length, use one or more intermediate expansion joints.

Locate your transverse contraction joints between expansion joints at intervals that will control transverse cracking. They must be placed also over expansion joints in the existing pavement that occur at shorter intervals than in the resurfacing. If possible place a contraction joint over wide cracks in the old pavement and always over contraction joints in the existing pavement.

The proper location of joints at street intersections is often a difficult problem. Fig. 6 shows a simple arrangement. Acute-angled or offset intersections are designed similarly, avoiding the intersection of joints at angles of less than 90 degress.



Courtesy Portland Cement Assn.

● **Fig. 6. THE LOCATION of expansion, contraction and longitudinal joints is shown for a typical street intersection on a cement concrete resurfacing job.**

It is extremely important that transverse joints be carefully installed. You must make joint faces accurately perpendicular to the subgrade. The full depth and width of expansion space must be clear of concrete or other material.

Because transverse expansion joints form free edges you should strengthen them. Use dowels or other load transfer devices to strengthen the slab ends. Dowels are plain steel bars placed across joints to make both slabs work together in carrying loads. They must be installed exactly parallel to the surface and center line of the slab. Because joints are installed to permit horizontal slab movement, dowels must not be bonded to the concrete of the slabs on both sides of the joint. Prevent bond in one slab by painting that half of the bar with red or sublimed blue lead and coating with a heavy oil just before its installation. A space must be provided at the painted and oiled end of the bar into which the bar can slide when the joint closes. Without this space the forces of expansion will bend the bar and damage the slab. The space provided should be about a half inch longer than the width of the expansion joint and may be formed by a sleeve about six inches long extending the necessary distance beyond the end of the dowel. Proper diameter of the dowels is not more than one-sixth the depth of the slab. Round, smooth bars, ¾ in. diameter and 1½ to 2 ft. long spaced about 1 foot apart, are used for slabs 4½ in. to 7 in. thick. For slabs less than 4½ in. thick, ⅝ in. round, smooth bars are preferred.

Dowels, or other load transfer devices, are often omitted at transverse contraction joints where adequate load transference is provided by the interlock of jagged edges along the crack below the groove. Load transference is most satisfactory where the maximum size of the aggregate is at least one inch and where you omit the expansion joints or place them at long intervals.

Use tie bars to prevent the separation of two slabs at a longitudinal joint and bond them to the concrete in both slabs. Generally ½ in. round deformed tie bars, 2 ft. 6 in.

long, spaced at intervals of 30 in. are used.

Bonding to Pavement

Several factors determine whether the concrete over-lay should be bonded to the existing pavement or not. If the new slab is less than three inches in thickness it must be bonded. For thickness of 3 in. or more you determine the need for bonding by the type and condition of the old pavement. If it is a bituminous surface you need no bond; and some engineers place a bituminous surface treatment on the old concrete to break the bond between the two layers of concrete. Generally there is some bond between an old concrete or block payment and the new slab; since this is the case, it is advisable to get the best possible bond so that resultant stresses are evenly distributed. You can use a thin layer of cement grout on the old concrete. Intimate contact between the old and new concrete is the important factor in obtaining bond. This means the old base must be perfectly clean and slightly damp when you apply the topping and the new concrete should flow into all the little depressions in the old base. Thorough compaction, often by vibration, is important.

Construction methods for concrete resurfacing are almost the same as for new pavements. When you lay concrete on an old pavement, less water is drawn from the mix than when it is laid on an earth subgrade. For this reason, when you widen at the same time as you resurface give special attention to wetting the earth subgrade. Fill deep holes in the old pavement with concrete before you place the top layer. Resurfacing should be especially well cured so the new concrete will not dry out and contract before it has developed strength to resist tensile stresses. Temporary bulkheads to place joints are held upright by stakes or metal pins. In resurfacing work you must drive these pins through the old pavement, which means that holes must be drilled for them in advance. In half-at-a-time constructions, the forms at the center line are best held in place by bracing them to planks held down on the old pavement by sand bags. Make contraction joints by cutting slots one-quarter of the depth of the slab. Form them by pushing the web of a T-bar into the concrete after it has been struck off and tamped, or cut them with a concrete saw after the concrete has set. The deformed metal plate joint can also be used for resurfacing work. Support it by metal chairs that do not require holes in the old slab.

Flexible Pavements

You can use several methods to add a new wearing surface to old flexible pavements. If the existing surface is rough you can smooth it by modern long base smoothing machines. These machines heat the existing bituminous surface and cut off the high spots and move that material into the low spots. The machine leaves a rather spotty surface appearance and you should follow it with a surface treatment or a layer of bituminous concrete.

If the old road is strong and only needs a renewal of the surface a standard surface treatment is adequate. If it is also somewhat rough you can improve the riding qualities by adding a road-mix. Make your road-mix by mixing aggregate and bituminous material on the existing road surface with blade graders, traveling rotary mixers or one of the traveling mixing plants. After spreading, roll thoroughly to consolidate the mixture and it is ready for traffic.

Some use a course of bituminous penetration macadam about three inches thick as a wearing course over old flexible pavements.

As in the case of rigid pavements, probably more engineers resurface flexible pavements with bituminous concrete than with any other material. You can use the same methods and materials as described under **Rigid Pavements** to re-surface flexible pavements except you will not need a prime coat unless the old pavement is very dry.

—END—

Courtesy Koehring Co.

"MUD-JACK" being used to force slurry of soil and water under pavement.

EDITOR'S NOTE: More to come—

The author and the Editors of PUBLIC WORKS appreciate that something more than improving the highway surface and correcting the alinement is necessary to make our highways adequate for carrying the present-day volume of high-speed traffic in a safe and efficient manner. We therefore plan to prepare and publish, in the near future, another article which will discuss those additional essentials to safe motor travel—traffic control devices, directional and other signs and signals, surface marking, channelizing and modern lighting.

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Reprints of this article will soon be available. While the supply lasts, one reprint will be sent free on receipt of request on your business letterhead or the Readers' Service card enclosed with January 1954 PUBLIC WORKS.

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STEEL FORCE MAIN

Provides

SEWERAGE FOR RESIDENTIAL AREA

SEWERAGE facilities have been provided for a rapidly developing residential area in a suburban part of New Orleans by the Sewerage and Water Board and at a considerable saving of time and money over former practice. Faced with limited funds, the board decided on several new design features for the project, which resulted in a saving of approximately one-fourth the cost of traditional installations of such facilities.

The board first decided to make itself responsible only for the laying of a 24 to 30-inch sewer force main through the newly developing area, leaving the construction of lateral lines and subsidiary pumping stations to building developers. The next saving was the board's decision to use, for the first time in New Orleans sewer work, steel pipe joined with Dresser couplings.

One of the unusual features of the project was the development of specially designed small pumping stations to pump sewage into the force main. Designed by board engineers, the stations are unique in that the pumps are 5 to 6 ft. above the invert of the entering sewer and are started by means of automatic equipment and vacuum pumps.

The $691,000 project was begun on Oct. 2, 1952, and completed early last summer. The line, which is 4.75 miles long will serve about 15,000 residents. It is located in the Gentilly section of the city near Highway 90 and the adjacent area toward Lake Pontchartrain. It starts from Louisa St. and Dwyer Rd. and crosses the Industrial Canal, continuing along Dwyer to the Farrar Canal. The crossing of the Industrial Canal presented the greatest installation problem and cost more than $74,000.

● **HANDLING pipe into trench using a tractor with side-boom.**

● **COUPLING and conductivity bond in place, ready to backfill.**

The city's pumping station No. 23 is involved in the operation of the new main. The series of small pumping stations along the main pump sanitary sewage to No. 23, which repumps it to a main in the developed section of the City. A series of lifts gets the material to the main outlet in the Mississippi River.

The new main consists of 21,000 feet of 30-inch pipe, reducing to 5200 feet of 24-inch at the far end. The steel pipe is one-quarter inch thick and sections are 40 ft. long. Pipe was supplied by the Bethlehem Steel Company. It was shipped to New Orleans by rail from Steelton, Pa. For jointing the pipe, there were required 472 30-inch Dresser couplings and 120 24-inch couplings.

Both the Sewerage and Water Board and the installation contractors, Boh Brothers Construction Company, were pleased at the ease and speed with which the pipe was laid and couplings installed.

The pipe was hauled by a specially designed high wheel "Hyster" truck (similar to the type used in lumber yards) from the storage yard to the job site where it was laid in the trench by means of a side boom bulldozer. The trench, dug with sloping sides, was excavated by a drag line. Ground conditions were bad and the pipe was installed as rapidly as possible before the trench sides had a chance to fail but sheeting or bracing of the trench was not necessary. Following a rainy period, the trench held some water and this caused slight delay. The contractor was especially gratified with the speed with which couplings were installed. It required two men only 20 minutes to couple each joint.

The trench section required excavation of about 2 cu. yds. per foot of line and total excavation approximated 50,000 cubic yards. The average depth of earth coverage was 4 feet and the minimum coverage, 3.5 feet.

● **UNUSUAL full-circle coating pan was used for coating joints.**

Prepared by Elsie Brubacher of the New Orleans Times-Picayune and checked by A. B. Wood, Gen. Supt., Sewerage & Water Board of New Orleans

Before the pipe joints were coupled, they were coated for protection against rust and corrosion. The pipe itself was coated inside and out with Bitumastic before being sent to New Orleans. This coating was omitted from the outside at the ends of the pipe, however, and before jointing these ends were cleaned free of rust and dirt, and coated with Vinyl primer and Vinyl outer coating. The outside of the center ring and the followers were coated with coal tar primer. Following the installation of Dresser couplings and Dresser electrical conductivity bonds, a pouring collar or "coating pan" was placed on the joint and was completely filled, as rapidly as possible, with hot bitumastic enamel. Excess coating material was then immediately drained off and the pouring collar removed.

The main was also provided with electrolytic protection, since the land through which it runs is a swampy area with considerable humus and very corrosive. For further protection the pipe was backfilled and surrounded with lakeshore sand. The first layer of sand was placed inside the trench by a Traxcavator before the pipe was laid and more sand was filled in over and around the pipe by hand. The balance of the backfilling was done by bulldozer.

Getting the pipe under the canal was a ticklish problem but was accomplished with fewer complications than were expected. The New Orleans Dock Board required that a channel 40 feet deep below water level be dug for the laying of the pipe. The trench, dug by suction dredge, is actually close to 50 feet deep. Into the same trench the New Orleans Public Service Co. placed eight 6-inch pipes for power lines.

It was a troublesome matter to keep the sewage main and the power pipes apart. A diver was employed for four days to check on underwater conditions and to see that the canal bottom was level following the filling of the trench. The channel is approximately 35 feet deep. For laying, the pipe was first joined on temporary pilings on the side of the channel for a length of 500 to 600 feet. It was then floated out into the canal and sunk in its final location. The contractor took what proved to be unnecessary precautions in floating the pipe. Fearful that the pipe would not float, drums were attached to keep it atop the water. When the pipe was guided to the trench location and the drums removed, however, it remained floating, the top of the pipe about a half inch below the surface of the water. It then required two days to weight the pipe and sink it the 35 feet to the bottom and then into the trench. The entire crossing took about a week to complete but interrupted navigation only two days.

The submerged pipe section is five-sixteenths of an inch thick and is covered by 1½ inches of concrete.

The Sewerage and Water Board are well pleased with the pipe's leakage record. After it was laid, the pipe was tested for leakage with a pressure of 100 pounds per square inch. The results were far within the specification requirement of leakage of 50 gallons per inch of diameter per mile of pipe per 24 hours. In fact, including leakage from valves and fittings, total leakage was only five percent of the allowable leakage.

Two of the specially designed small pumping stations have so far been installed by builders and are in operation in the area served by the main. There may ultimately be as many as 20 such stations. They were designed by the board and cost approximately $10,000 each.

The board's initial saving in this project may well be increased in the months and years ahead as other similar projects in expanding sections are undertaken.

● **LINE completed and ready for covering. Bulldozer in background is placing fill. Most difficult job was crossing of the Industrial Canal at depth of 40 ft.**

• • •

Grease in Sewage Sludges

At the sewage treatment plant of the Minneapolis-St. Paul Sanitary District it has been noticed that during the past few years the sludge quality has been deteriorating gradually; particularly that the grease content has been increasing and the flowability and filterability have been decreasing. Since 1945, the grease content of the dry-weather sludges has increased 27.9%. Commenting on this, it is suggested in the report on the operation of the plant for the year 1952 that this change may be due to one or more of the following causes:

1. The rapidly increasing use of detergents, the phosphate content of which is said to cause a bulky sludge requiring more coagulant chemicals.
2. The gradually increasing use of garbage grinders, contributing more grease to the sludge.
3. The increased per capita consumption of meat, up 19% compared with the period before World War 11, probably accompanied by more grease discharge to the sewer systems.
4. The increasing average age of the sludge solids prior to filtration, as the sewer system is expanded to outlying areas and the average flow time to the plant increases.
5. Growth of the vegetable oil (soybean, linseed, etc.) industry in this area, probably accompanied by increased quantities of these oils reaching the sewers in the wastes from these industries, and expansion of production at the Twin City Ordinance Plant which uses considerable quantities of greases and cutting oils and discharges several million gallons of wastes to the sewer system daily.

Solving WISCONSIN'S WATER PROBLEMS

AT the meeting last September of the Wisconsin Section, American Water Works Association, a number of interesting papers were presented. Abstracts of certain of these, forwarded to us through the kindness of L. A. Smith, Section Secretary, follow. They deal primarily with the solution of problems incident to Wisconsin conditions.

Surface Water: "Washing and Maintenance of Filters" was discussed by John R. Baylis, Engineer of Water Purification, Chicago Bureau of Engineering. Mr. Baylis' paper was based principally on his many years of experience in the operation and maintenance of the filter plant, especially in Chicago. The character of the water handled by the South Chicago District Filter Plant varies widely so that filter runs may range from 1½ to 100 hours before reaching a head loss of 8 feet. The number of filter washes per day in this plant reached a record high of 385 in 1953. Filter clogging is caused primarily by certain microscopical organisms occurring in great number when the water is clear and there is less tendency for them to be removed with suspended matter in the settling basins.

His paper described in detail filter difficulties such as mud ball formation, formation of clogged areas, loss of sand, etc., together with the advantages of surface wash and variations in the wash rate. By the use of slides, surface clogging by various microscopical organisms was illustrated, as well as the resulting difficulty when mud balls form, and the displacement of sand and gravel resulting from improper back wash. It was the speaker's opinion that if a filter is properly constructed, operated, and maintained, little loss of sand should occur and a filter should not require rebuilding for 15 to 20 years.

"Taste and Odor Experiences" was discussed by William U. Gallaher, Plant Superintendent of the Appleton Water Department. The character of the Fox River water used by the City of Appleton, was given. Mr. Gallaher has had much experience in taste and odor control. Appleton's tastes and odors are caused not only by algae but microscopical organisms that occur in the river water, as well as by the discharge of industrial wastes from time to time without any previous warnings. The character of the raw water changes very rapidly, making it necessary to change the chemical requirements necessary to meet the varying conditions. To a large extent, it is necessary for the operator to detect the changes in taste and odor and change his form of treatment accordingly. Consequently, the human element is involved. Therefore it is not unusual for water to reach the distribution system before tastes and odors are corrected, resulting in frequent complaints from the consumer. This is especially true during certain periods of the spring run-off when changes occur very rapidly.

Distribution and Pumping: Wm. Hammann, Engineer, Water Construction Division, Milwaukee, reviewed Wisconsin practices concerning hydrant installation, maintenance and repair. Most of the material presented was derived from replies received to a questionnaire forwarded to approximately 75 Wisconsin waterworks superintendents. Information was tabulated on such items as spacing of hydrants, number per mile of main, primary use, controls over use, painting for identity of use and size of feeder main, hydrant drainage, design characteristics, etc. Mr. S. J. Duszynski, City Engineer, Cudahy, a panel member of the session, began the discussion of this paper. Group discussion revealed a primary interest in the drainage provisions, types of designs, legality of collection from those who damage hydrants and location and orientation of hydrants and nozzle openings from the viewpoint of fire departments.

"The Economic Selection and Replacement of Pumping Equipment" was presented by O. J. Knechtges, Hydraulic Engineer, Mead and Hunt, Inc. His paper stressed the value of providing in the pumphouse equipment which will permit the determination of wire to water efficiency. A careful study was likewise urged of the necessary rate of pump delivery from a well since over-development increases the size of pumping unit and the lift from the well, factors which affect pumping costs. The advantages and disadvantages of the various type pumps, Q-H curve characteristics, improvements in pump and motor design were reviewed from the economic analysis viewpoint. This paper was discussed by Arno T. Lenz, Professor of Civil Engineering, University of Wisconsin, who emphasized the importance of the need to know your pumping equipment and to write exacting specifications to which pump manufacturers can be held.

Office Records for Tomorrow: J. A. Hammes of the Sheboygan Water Works read a paper on "Customer Accounting", describing the "stub plan", ledgerless customer billing in use at Sheboygan. An outstanding feature of the plan is the system of folio numbering, which was instituted 23 years ago, and by a pre-numbering scheme on a Master Meter Route Map, which is capable of handling all additions and changes in accounts without any confusion and delay. Routing and numbering is simply a matter of fitting the account into its predetermined slot, and subsequent changes are entirely unnecessary.

The Sheboygan Water Works uses Burroughs Bookkeeping Machines, with quarterly billing for all except certain industrial accounts which are billed monthly. Bills are hand delivered to insure promptness and accuracy, with posting of paid accounts a simple matter of pulling the paid stubs and placing them in a paid file. Accounts remaining unpaid are easily checked as they are the only ones remaining in the unpaid file.

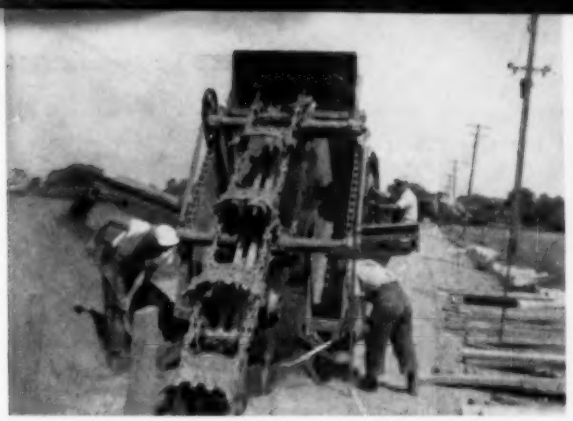
Machine billing has been the answer to the customer accounting problem at Sheboygan because of its accuracy and flexibility, and the neatness and the speed of obtaining bills and accurate statistical data.

HOW WATER DEPARTMENTS USE LABOR SAVING EQUIPMENT

● **CANTON, OHIO.** Power crane, above left, unloads pipe from cars to storage at yards. Above, dragline is trenching for water main. Also used are radio, power tappers, power borers, clam and crane. Ralph Schlott, Supervisor of Distribution.

● **WILLIAMSTOWN, Mass.** LeRoi tractor equipped with air compressor and bulldozer blade speeds the work. Charles F. Notsley, Sup't. Water Dep't.

● **DENVER, COLO.** It is wet underfoot, but the Quickway truck-mounted shovel digs water main trenches for the Board of Water Commrs.



● ANTIGO, Wisc. "Our Buckeye traction ditcher has proved most valuable to us in our work." H. A. Ehlers, Sup't. Water & Sewerage.

● DENVER, Colorado. A Quickway truck-mounted shovel is shown here moving forms on a mountain project for the Board of Water Commrs.

● HAMILTON, O. "During the process of rebuilding our sand filters, the sand is removed to the outside with an ejector, and then picked up with a front-end loader. We have enlarged the filter room windows so that the front-end loader can pass the sand into the filters. The photo at the right shows how this is done, the loader mounting a movable ramp to get the elevation. This saves considerable in labor costs and is typical of the many jobs we find for the loader to do." H. W. Augenstein, Sup't.

● MISSOULA, Mont.—"Our truck-mounted Bantam backhoe, used for digging for leaks and for short extensions, saves very valuable time in emergencies. Our department trucks are radio-equipped." R. G. Cronin, Gen. Foreman, Montana Power Co.

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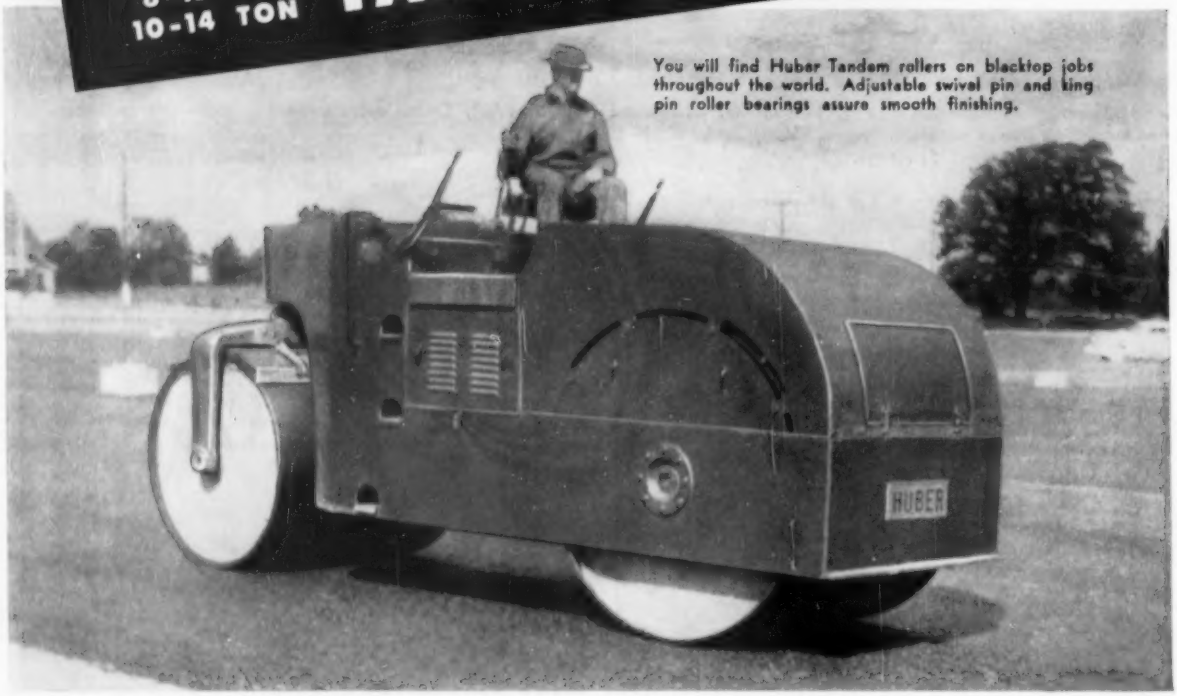

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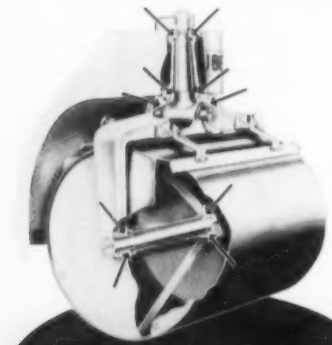

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APWA News

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Northern California Chapter Holds Annual Meeting

Over 100 Members and Guests Attend Oakland Meeting

OAKLAND, CALIF.—Howard Gardner, Assistant Director of the League of California Cities, was a featured speaker at the Annual Meeting of the Northern California Chapter, November 13th at Oakland. His subject, "Developing League Policies Relating to Public Works", proved interesting to over 100 members and guests present at the meeting.

Concurrent sessions were held during the afternoon at which time the following subjects were discussed: "Infiltration in Sanitary Sewers"; "Co-operative Storm-Sewer Projects between City, State and Private Individuals"; and "Relations Pertaining to Planning and Construction Projects—Contractor, Engineer, Manufacturing and Utility Companies". The discussions were moderated by H. A. Knudsen, Manager, Sewage Disposal Division, East Bay Municipal Utilities District; Raymond Boege, City Manager and City Engineer, San Rafael; and B. K. Dunshee, Manager, Land Department, Pacific Gas and Electric Company.

The late afternoon and evening were devoted to relaxation and the making of new friendships at a cocktail hour, and dinner-dancing program.

MINNESOTA MEMBERS TO ASSIST IN HIGHWAY NEEDS STUDY

MINNEAPOLIS—C. E. Dahlgren, City Engineer of St. Peter, Minnesota and Secretary-Treasurer of the Minnesota Chapter reports that a League-sponsored meeting of Mayors, City Managers, City Engineers and City Attorneys was held on the campus of the University of Minnesota, November 30th. A special Chapter Meeting was held following the dinner. S. F. Coffman of the Automotive Safety Foundation explained how members of the Chapter could assist the Highways Study Commission in preparing its report for the next session of the Legislature on state and local highway needs. Uniform standards for appraising highway needs will soon be distributed with the report forms which are requested to be returned. Every effort should be made, he explained, to complete the form in accordance with the established standards. This, he said, will provide the factual information needed to develop sound highway legislation. Mr. Coffman stated that the following Chapter Members had been selected to serve on an advisory committee to the Highway Study Commission: James F. Enz, City Engineer, Red Wing; Arthur W. Tews, City Engineer, Duluth; Hugo G. Erickson, City Engineer, Minneapolis; R. E. Teague, St. Cloud; R. W. Hussey, City Engineer, Crookston; and Philip Smith, Village Engineer, St. Louis Park.

Proceedings—1953 Public Works Congress

Twelve interesting papers presented at the New Orleans Public Works Congress appear in the Proceedings of the 59th Annual Meeting of the American Public Works Association, which is now available from the Association's Headquarters office. The proceedings are priced at $5.00 per copy, but are distributed to members, upon request, at no charge. Titles of the papers included in the Proceedings are: The Backbone of Civil Defense; Street Uses; and Some Principles In Design and Operation of Municipal Incinerators. In addition, papers dealing with the processes, economics and operational problems of composting are included. Three aspects of the subject of inter-governmental relations in public works are discussed in papers dealing with Sewage Treatment, Streets and Highways, and Water Supply Distribution. Also included are papers on Budget Preparation and Control, Work Programs and Work Units which were presented at a symposium on Performance Budgeting in Public Works.

Film of the Month

Sanitary Storage and Collection of Refuse is a 19-minute sound-color movie which was produced in 1952. It is available free, on a short loan from: Medical-Officer-in-Charge, Communicable Disease Center, Department of Health, Education and Welfare, 50 Seventh Street, N. E., Atlanta 5, Georgia. The film consists of a review of the ideal conditions desired on the premises for the storage and collection of community wastes.

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Yearbook Directory Mailed to Members

The 1953 Yearbook-Directory listing the names and addresses of over 2200 members of the American Public Works Association has just been published. Copies are now being mailed to all members. Non-members may secure this publication from the headquarters office for $3.00 per copy. Local Chapter Officers, and APWA Committees are included in the 1953 edition of this annual publication. Also included are many advertisements of public works products and a directory of municipal engineering consultants.

Special Report on Sewage Service Charges

A special report containing up-to-date information on sewage service charges in cities over 5,000 population is now available from headquarters of the Association. Comparative monthly residential charges; billing and per capita revenues; and billing and collection practices are furnished. Price $2.00; 40% discount to members; additional 10% off for cash with order.

Michigan Meeting Features New Carport

ANN ARBOR, MICH.—George Sandenburgh, City Engineer of Ann Arbor, served as host to the most recent get-together, November 19th, of the Michigan Chapter, which was a joint meeting with the Southern Michigan Public Works Forum. Over 80 public works officials throughout the state attended the meeting which featured an inspection trip through Ann Arbor's new 422-car parking structure. The new "Carport"—the second in Ann Arbor—is another significant step in a comprehensive program developed by Mayor William E. Brown, Jr. to build adequate down-town parking facilities for the city's automobile population. The new structure cost $426,000, and is to be operated on a self liquidating basis without the use of any tax money.

This new addition will give Ann Arbor a total of 992 off-street parking spaces in two structures and five surface lots. In addition to these facilities, the city has about 1,000 parking meters on the city streets. The total assets of the entire system are now set at $1,432,400. Parking fees for the new building will be the same as at all other city lots: 10 cents for the first two hours or any part thereof and 5 cents for each additional hour thereafter. A flat rate of 15 cents will be charged for theater parking at the structure after 6 PM.

George Granger Brown, Dean of the College of Engineering, University of Michigan spoke at the noon luncheon. His talk concerned the University's new North Campus Development which was visited during the afternoon. Earnest Boyce, Professor of Municipal and Sanitary Engineering at the University, gave an interesting talk on the sanitation problems facing Indonesia, based on his trip to that far eastern country last year.

Write for Details about APWA Membership Today

Each month special news items are included in this column to acquaint our readers with the activities and nature of services rendered by the APWA. Supplemental information concerning items appearing in this column is presented in the Association's Newsletter. Find out about the advantages of the $10. membership today by writing to the Executive Director, 1313 East 60th Street, Chicago 37, Illinois.

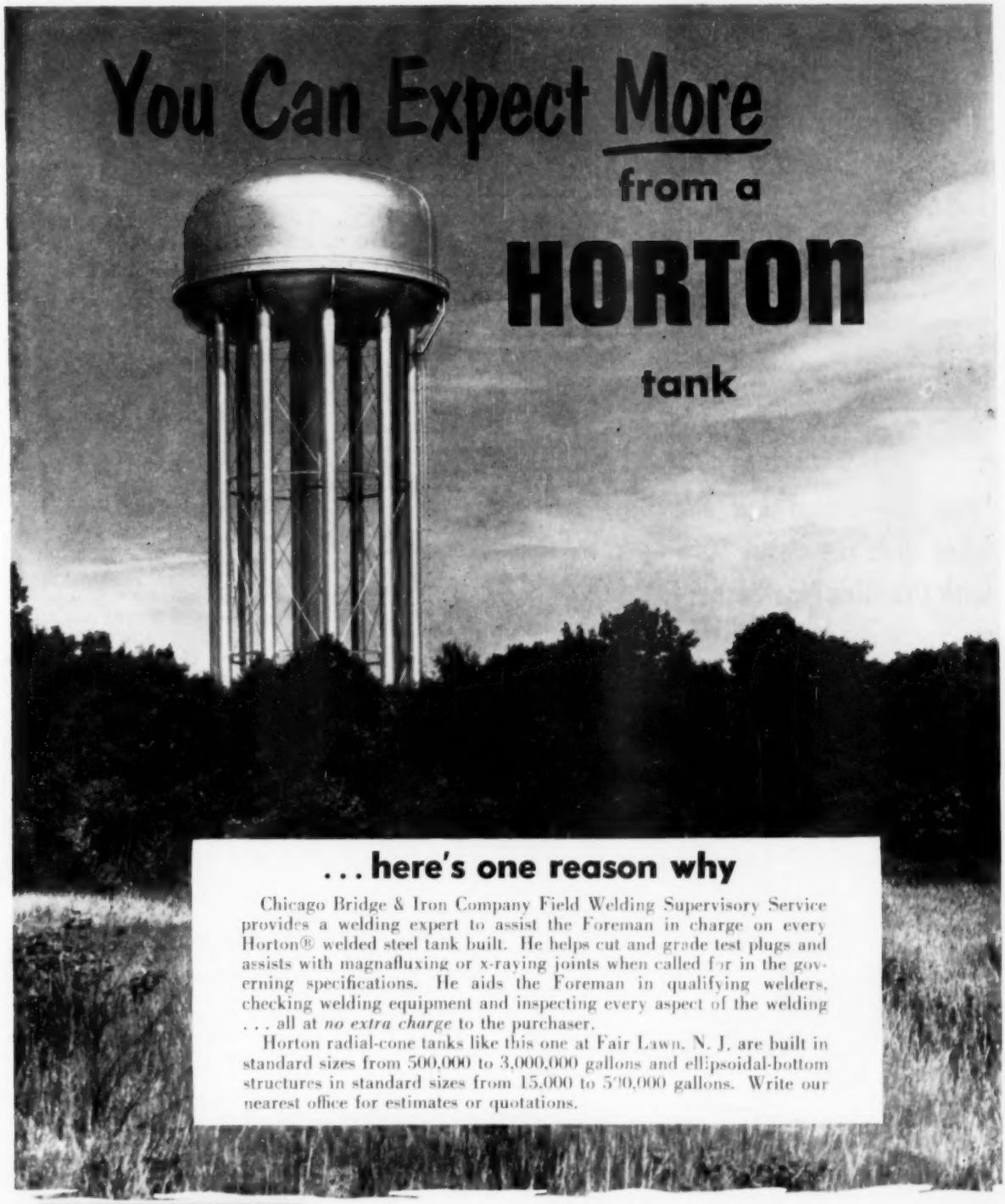
● **Campus developments at the University of Michigan and the Carport newly added to Ann Arbor's parking facilities were inspected by Michigan members.**

PLANS UNDERWAY FOR "SMALL WATERSHEDS" PROGRAM

THE recent Congress appropriated $5,000,000 for first-year planning and treatment of soil conservation projects on 65 widely distributed small watersheds, most of them with only a few square miles area. The objectives of this program are: 1—Reduction to the fullest practicable extent of floodwater, sediment, and land damage in the watershed and downstream; 2—Demonstration of the feasibility of local-federal cooperation and cost sharing; 3—Testing of the effectiveness of control measures under the highly variable conditions of the different sections of the country and where they can readily be observed by local people; and 4—Accumulation and analysis of data on precipitation, streamflow, sediment loads, and flood peaks as the treatment progresses to guide future flood prevention activities. The 65 watersheds have been selected on the basis of: (1) High-priority need for and practicability of watershed protection; and (2) the likelihood that local people and organizations can complete the work on them in a relatively short time with appropriate assistance from state and federal agencies. About half of the cost will be borne by the federal government and the other half by land owners, local organizations and states. The Soil Conservation Service is responsible for developing the program; the Dept. of Agriculture gives assistance. Forestry assistance will be provided to land owners by the U. S. Forest Service and the State forestry organizations.

The 65 watersheds selected are distributed among 35 states. Kansas contains the largest number—6; 4 are situated in each of the states Kentucky, Nebraska, New York and Texas; 3 in California, Illinois, Iowa and Minnesota; 2 in Arizona, Missouri, New Jersey, New Mexico, Ohio, Utah and Washington; and one in each of the other 19 states.

The developing and proving by this program of the best methods for minimizing the sediment burden of streams from small watersheds should be valuable to waterworks utilities which make use of impounding reservoirs; the useful life of many of which is being shortened seriously by deposits of sediment therein.



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Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association.

Public Works Planning

The Chairman of President Eisenhower's Council of Economic Advisers told the American Assembly Conference on Economic Security that large scale public works are being planned as one of several stand-bys against a possible depression.

Dr. Arthur F. Burns said that the advisory council had already gone "some distance" in blueprinting plans. Some of them will be ready for action by the second session of the 83rd Congress, in January. The plan is to strengthen the national economy to resist any business depression or cushion the hardships if one came anyway. He said that some of the planned measures should be authorized soon, by Congress, so that they could be effected by Executive Order if it should become necessary to do so.

Civil Defense For Water

Operation and Repair of Water Facilities in Civil Defense Emergencies, Federal Civil Defense Administration Technical Manual, 63 pp., $0.25, U. S. Government Printing Office, Washington 25, D. C. This is one of a series of technical manuals issued by the Federal Civil Defense Administration covering specialized information for technical fields.

Ohio Highway Bond Issue

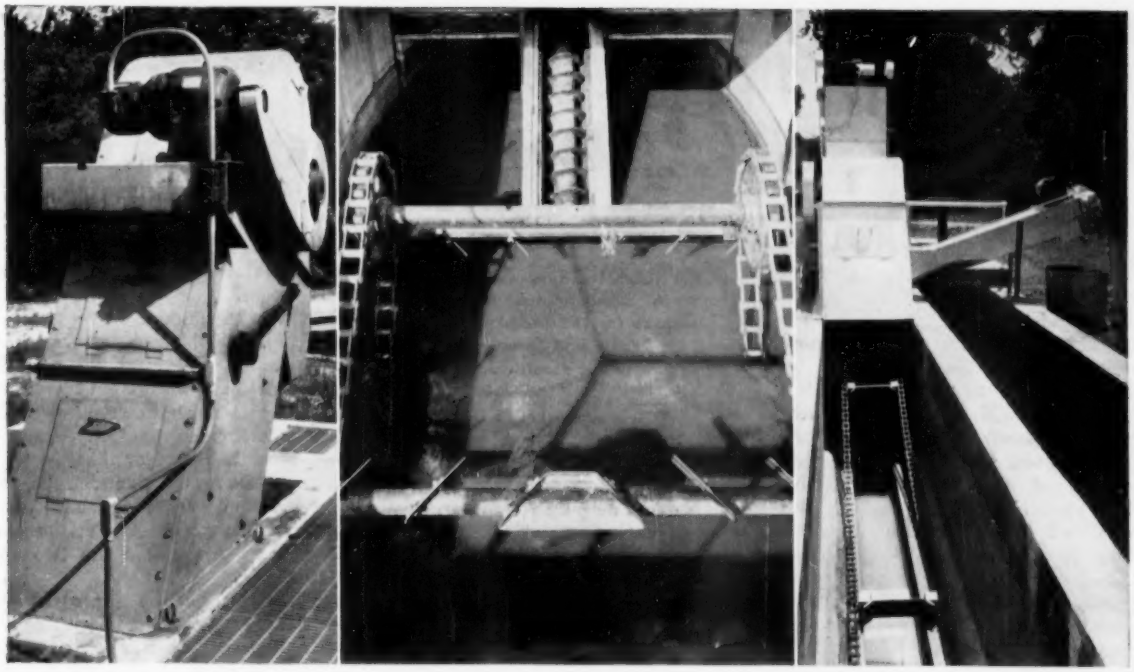
The $500 million revenue bond issue for major highways and urban extensions, which was sponsored and supported by several member associations of the Ohio Highway Users Conference, was approved by the votors of Ohio on November 3. The amendment provides that no more than $125 million of the authorized debt shall be contracted within any calendar year. The proceeds of the bond issue are to be expended only "to provide adequate highways," including the acquisition of rights-of-way . . . "but excluding the costs of planning and supervision by the state." The bonded indebtedness is to be secured by a pledge of state motor vehicle registration fees, taxes levied for the use of vehicles on public highways, and state motor fuel taxes.

Electrical Code Revised

After an extensive review, the National Electrical Code has been brought up to date and now appears in a new edition which incorporates several new articles and many revisions and additions to present articles. Some of the important new articles are as follows: *Article 330* —Contains nine new sections covering the newly recognized Type MI cable; *Article 339* — Contains two sections covering the use of the new Type UF cable; *Article 353*—covers multi-outlet assemblies.

Important additions to existing articles are: *Article 210* — revised section 2113 covers branch circuits and recognizes 277 volt circuits for fluorescent lighting; *Article 250* — several sections on grounding have been revised, but of particular interest to utilities is section 2560 covering grounding of electric clothes dryers in the same manner as are electric ranges; *Article 422* — new sections 4271 to 4286 inclusive—cover space heating appliances and equipment.

An "Analysis of the 1953 Revision of National Electrical Code" can be obtained at 30 cents per copy from the National Electrical Manufacturers Association, 155 E. 44th St., New York 17, New York. The Code itself is published in an inexpensive, small-sized edition (National Electrical Code, C1-1953 NBFU 70) at 10 cents each or in a larger paper bound edition (NFPA 70) at $1.00 per copy or cloth-bound at $3.00. Copies may be ordered through the American Standards Association, Inc., 70 E. 45th St., New York 17, N. Y., at the above prices.



TRITOR SCREENS—At small sewage treatment plants—where grit creates a problem during storm flows, this one machine accomplishes the effective, low-cost removal of both screenings and grit.

STRAIGHTLINE GRIT CHAMBERS—For the removal of a clean, washed grit with a low putrescible content. The complete collection and thorough cleaning operation makes further handling unnecessary.

STRAIGHTLINE GRIT COLLECTORS—On this bucket type collector, water sprays wash the grit from the buckets into a separate washing and dewatering screw. Photo also shows Link-Belt Bar Screen.

How to get flexible, low-cost grit removal

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For example, with the Tritor Screen, a grinder may be used to shred the screenings when no grit is received. During storms, the grinder may be by-passed and grit and screenings disposed of by fill, burial or incineration. Similarly, the Straightline grit collector is designed either with a pitched flight collector and dewatering and washing screw discharging direct from the grit chamber—or with a bucket type collector for deep chambers.

In addition to grit handling and washing equipment, Link-Belt manufactures a complete line of equipment for water, sewage and industrial waste treatment plants. A call to the Link-Belt office near you will put you in touch with an experienced sanitary engineer. He'll work with your engineers, chemists and consultants—help you get the best in modern treatment equipment.

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REPORT ON THE FORTHCOMING 10th EDITION of "STANDARD METHODS"

F. WELLINGTON GILCREAS
Chairman, Subcommittee on Standard Methods for the Examination of Water and Sewage, American Public Health Association

THE 10th edition of *Standard Methods for the Examination of Water, Sewage, and Industrial Wastes* has been in preparation for the last two years, and it is now anticipated that the volume will be ready for sale not later than July 1, 1954. As with previous editions, it was prepared under the sponsorship of a Joint Editorial Board which consists of representatives of the three participating organizations, the American Public Health Association, the American Water Works Association, and the Federation of Sewage and Industrial Wastes Associations. Since it is the first issuance of the volume since 1946, when the 9th edition was published, it contains many changes in methods in order to conform to current developments in laboratory examinations of water and sewage. Some old methods have disappeared, new ones have been added, and many of those that have been carried through numerous editions have been modernized in accordance with recent investigations of problems in the development of laboratory technics.

Methods in the book will be designated as standard or tentative. The former practice of including in the *Appendix* nonstandard methods has been eliminated. The book has been organized in six sections instead of four, namely:

I. Physical and Chemical Examination of Water
II. Physical and Chemical Examination of Sewages, Effluents and Polluted Waters
III. Physical and Chemical Examination of Industrial Wastes and Effluents
IV. Physical and Chemical Examination of Sludges and Bottom Sediment
V. Bacteriologic Examination of Water and Sewage
VI. Biological Methods for the Examination of Water, Sewage Sludge, and the Bottom Sediments of Lakes and Streams

The two-column page format will be retained, but in order to avoid confusion, new methods will appear at the top of the page, thus simplifying location of a specific method in the book.

Part I. Physical and Chemical Examination of Water, has been changed in its general development and scope. The purpose and application of each method is discussed. The reasons for using it and the points to be noted when different technics are proposed are discussed in full. Interferences with technics are mentioned as well as procedures for their elimination in the examination of specific samples. The precision and accuracy of each method is given as an aid to the analyst in appraising the value of the results. Many of the technics have been completely rewritten, and the use of photometric methods is recommended when applicable to a specific procedure. The expressions "milligrams per liter" and "milli-equivalents per liter" are recommended for reporting results of chemical determinations, but are not required. The older concept of "parts per million" will be continued and will undoubtedly still be used for designating the results of analytical determinations.

Parts II and III contain many minor changes in order to conform to developments in research and laboratory procedures. The major change in this part of the book is the addition of Part III on the examination of industrial wastes and effluents. These methods are presented for the first time, and many of them are new, developed as a result of the growing interest in the enlarging field of treatment and disposal of effluents of industrial manufacturing processes. Some of these methods are not as well tried or proven as the older technics in Part I. However, their publication in the volume will stimulate research in this field.

One new concept is that of determination of chlorine requirement in place of the older designation of chlorine demand. Not only is this a new designation but it also covers a more rational development ot technics for determining this essential to chlorination treatment, particularly of wastes.

In Part V, the bacteriologic examinations, the requirements for glassware and equipment have been modified to agree more closely with requirements in the 10th edition of *Standard Methods for the Examination of Dairy Products*. Thus, the specifications for incubators, sterilizers, glassware, etc., conform as closely as possible in the two volumes.

Tryptone glucose extract agar without skim milk has been adopted as the standard medium for the standard plate count. The coliform test has been broadened to permit the use of lauryl tryptose broth in place of standard lactose broth in the presumptive test. Confirmation of tubes showing gas is still required regardless of which presumptive test medium is employed.

The application of the membrane filter technic to the bacteriologic examination of water has been completely studied by a committee of the American Public Health Association and a detailed technic for this determination was developed, which has been included in the 10th edition of *Standard Methods* as a tentative method. The use of the M.P.N. index for reporting densities of coliform bacteria has been continued and the number of tables for computing these indexes increased by the inclusion of one giving the index when three replicate portions of a series of three or more volumes are employed. The older method of reporting coliform densities by the Indicated Number has been eliminated.

A new section has been added to Part V providing suggested methods for the detection and enumeration of the higher bacterial forms, sometimes designated as nuisance bacteria. These are tentative methods, and it is hoped that their inclusion in the volume will stimulate further investigation of these technics with the view that proven standard methods may gradually be developed.

As in the past, excerpts from the British standard methods have been

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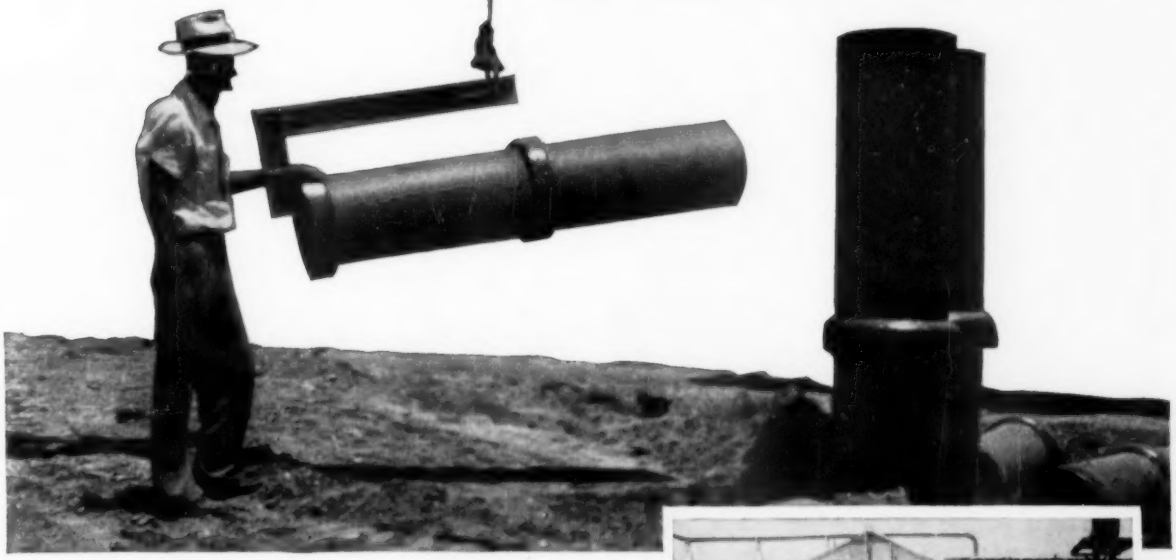

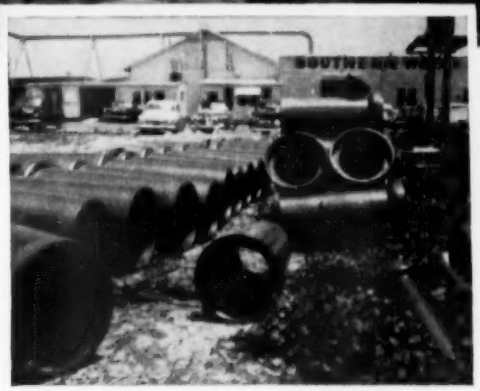

When a municipal sewerage project is financed by bonds that won't mature until 1993, the pipe has to be good. It *must* not fail—especially before the bond issue has been retired. That's why city officials and sewerage contractors all over the country confidently specify, buy, and install Vitrified Clay Pipe. They know Clay Pipe is the *only* pipe . . .

- **Completely unaffected by sewage acids and corrosive industrial wastes . . .**
- **Sure to last regardless of the fluids that may flow through it in the future . . .**
- **Guaranteed for 50 years!**

The $27 million bond issue launched by the city of Miami will cover long-needed sewerage improvements that will require hundreds of thousands of feet of Vitrified Clay Pipe. In the 79th St. installation shown here—a small part of the overall project—some 12,000 feet of Clay Pipe were installed. City of Miami officials who directed various phases of this project are: Engineer Arthur E. Darlow, Inspector Frank Allen, and Supervisor of Sewer Design W. B. Lewis. Under the direction of General Contractor Joe Reinertson, Inc., were Design Engineer W. T. Eefting, Job Superintendent Tom Bryson, and Superintendent of Construction Inspection Fred Righter.

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included, largely for informational purposes. In the 9th edition only a discussion of the *rationale* of the British methods was published, but the 10th will have that plus the directions for carrying out the technical procedures for many years used in Great Britain. These are listed as tentative methods and are not established as alternatives to standard methods for the plate count and the coliform test.

Part VI, the biological and microscopic methods, has been completely revised. This section has been greatly expanded to include a discussion of sampling and storage procedures as well as methods for the indentification of species. For the first time, line drawings and photographs of microorganisms are included in the volume as an aid to identification of species which are detected during the biological examination. Both the areal standard unit and the volume standard unit are incorporated as standard procedures for reporting the results of biologic examinations.

It is hoped that editions of *Standard Methods* may be brought out more frequently than has been the case in the past in order that changes in procedures may be recommended in the established technics to keep pace with developments in the science. Provisions are being considered for approving changes in technics between editions, and research for establishing new or modified methods, equivalent to or an improvement over those of the current edition, is being planned. It is hoped that the 11th edition will be published without a lapse of eight years between it and the 10th.

• • •

If You Have to Analyze Flows in Pipe Networks—

A machine has been developed which will analyze quickly and accurately the flows in a pipe system. This is the McIlroy analyzer, which was developed by Prof. Malcolm McIlroy of Cornell University. The analyzer may be used for gas, water, oil, steam and air. Fluistors are placed in the pipe network; the analyzer then computes pressure and flow readings. Though the unit sounds complicated, it is applicable even to small installations. One client is stated to have saved more than twice the cost of the equipment on a single analysis covering a small extension to a water system.

• • •

Portable Grizzly Speeds Road-Building

AN ingenious way of screening unclassified excavation which had to be used on a road construction job requiring a select base and speeding up its job in the process has been devised by a contracting firm. McKinnon-Decker Co., Helena, Mont., was required to move 21,300 cubic yards of this unclassified material from a pit to the road job it had contracted. The logical solution would be to build or buy a stationary grizzly. But McKinnon-Decker wanted a speedier method. So it built its own grizzlies to fit right over the bowls of the three Caterpillar No. 10 Scrapers being shovel-loaded on this job. This eliminated all of the problems of a stationary grizzly which would have to be moved every time the shovel was transferred to a new location.

The grizzly was fabricated for each No. 10 Scraper from used mine rails, 2½ by 2½-inch angles and sheet steel sideboards. The rail was spaced to take only rock as specified by the job and the slope was designed so that the oversize could clean out without jamming. It was built so that it could be easily mounted or detached.

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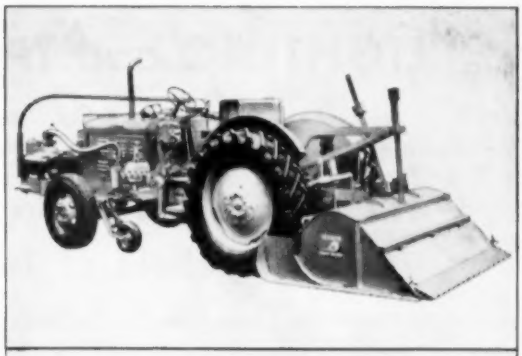
The SEAMAN MIXER constructs a pavement at a saving in processing costs that ranges up to 50%. And the street or highway — whether of asphalt, oil, tars, asphalt emulsions, soil-cement, or any type of stabilization — is stronger, higher load-bearing and far more resistant to weather-effects. And the SEAMAN processes with a minimum of interference with traffic. Daily production is higher, labor costs are lower.

Here are sound reasons for these benefits —

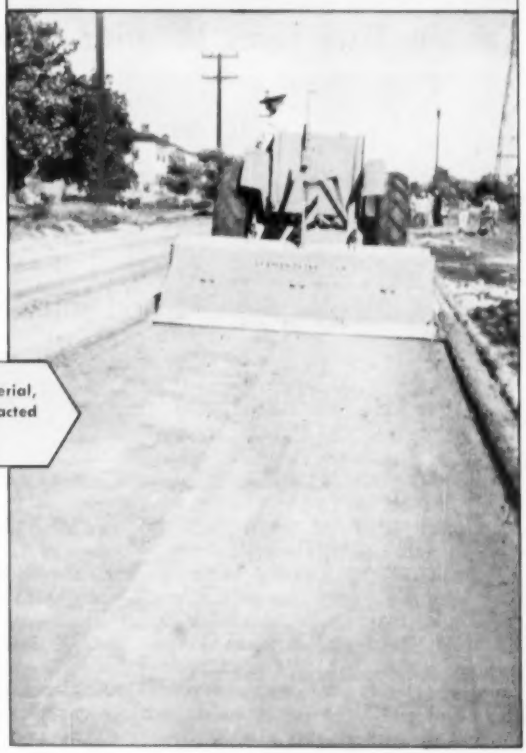
1. **The SEAMAN method of in-place mixing involves a minimum of materials transport and handling.**
2. **The SEAMAN *corrects* aggregate segregation (the separation of coarse and fines). It blends, mixes and *places* them uniformly so that voids are filled and the coarse material is interlocked and securely mortared-in.**
3. **Daily output is higher. A mile a day can be attained if sections are not too short.**
4. **Only one man to operate.**
5. **The SEAMAN finishes to final grade and crown, with the mix in partially pre-compacted stage, ready for finish rolling.**
6. **Mixes right up to edge of curb.**
7. **One-half of street can be kept open for traffic.**

This year, get a SEAMAN in your budget. Get more miles of better streets with your appropriation.



SEAMAN Self-Propelled TRAV-L-PLANT. 7 ft. Mixing Width, Gasoline or Diesel Powered, with 200 G.P.M. pump for highly accurate application of binder.

Reclaiming old bituminous street. At left scarifier rips up pavement. At right SEAMAN Self-Propelled MIXER pulverizes scarified material to reduce it to approximately original aggregate size for reconstruction of pavement.



SEAMAN MIXER mixing, blending and placing material, keeping it to crown and grade in partially pre-compacted condition ready for finish rolling.

This Bulletin describes mixing processes with the SEAMAN — and tells *why* a SEAMAN Mix is superior — also gives a complete description of the SEAMAN TRAV-L-PLANT and the SEAMAN Self-Propelled MIXER. Just write for Bulletin TPS.

SEAMAN MOTORS *Inc.*

266 N. 25th Street Milwaukee 3, Wisconsin

LIGHTING and TRAFFIC *Control*

12 Basic Steps to Break the Stranglehold of Traffic

REPRESENTATIVES from the fields of government, city planning, architecture, retailing, automotives, parking, mass transportation and traffic—44 in all—sat around a table a few months ago to discuss the pressing problem of urban traffic congestion. They sought answers to a thorny question: "How can big cities save their downtown districts from strangling in their own congestion?" Architectural Forum Magazine sponsored the event, which was provided over by P. I. Prentice, Editor and Publisher.

The answers that are briefly outlined below represent the collective and unanimous opinions of the group. Some of the ideas expressed have already proven successful in Pittsburgh's great rehabilitation. Others are being translated into actuality in many other American cities.

As these ideas, which include important new concepts in tackling the problem, are going to affect every city and the thinking of those businessmen who are willing to work to save their downtown investments, you should know what is in the planning stage so that you can help guide the thinking on this vital subject.

What follows is a bare summary of the ideas developed. Complete details of the conference can be obtained without charge from Architectural Forum.

1. Integrated efforts; realistic goals.—Although the traffic problem is made up of many "symptoms", they must all be solved together. A super-highway is useless if it brings more cars downtown without more facilities to park them. The City should have broad responsibility and authority to face the whole problem. A municipal parking authority should have the right of eminent domain. A coordinating citizen's group, like the Allegheny Conference in Pittsburgh, speaks for all the people rather than for special interests.

With the best organization, no success can be realized without first setting realistic goals. Money and space are limited. To park all cars seeking to enter downtown Boston, for example, one third of all buildings would have to be torn down; each new rush hour commuter would cost a city $4,000 in highways and parking space. Mass transportation is the realistic answer.

2. Put a price on street space. At present, downtown street space is rationed by congestion; first-come-first-served determines the market value of curb space. Wouldn't a price mechanism be more intelligent? If, instead of parking free, or almost free, a motorist or a trucker had to pay a price closer to the true value of street and curb facilities he uses, wouldn't more high-value space become available?

3. Constructive decentralization.—Offices and department stores need easy access for many persons; they need central location and mass transportation. They also bring more business downtown, generating more value. Other businesses, needing space to handle goods in volume rather than people, are located downtown through historical accident. A move to the suburbs by the latter would help.

4. Separate car and truck traffic.—Trucks are major offenders, tying-up downtown traffic when they unload, stand at the curb or maneuver for space. If businesses requiring many truck shipments cannot relocate out of district, off-street facilities should be provided. If that is impossible, loading and unloading should take place during uncrowded early morning or late afternoon hours. City can help with zoning laws, building ordinances and special hours for trucks. But where city power is limited, private enterprise must help itself by self-regulation. Truckers should charge for time lost in congestion, as taxicabs do, making it desirable for shippers to use different hours.

5. Intelligent redevelopment.—Blighted areas adjoining downtown business districts should be cleared and rebuilt, with broader streets, more parking space, peripheral expressways and parks. Eminent domain—that is, public power to condemn, lease, sell, and regulate land—should be used where necessary.

Casualty Data Slows Motorists on Alabama Highway

ERNEST W. FAIR

NO matter how many warning signs we erect at dangerous intersections they always seem to fail at "total effect" and accidents keep occurring though they do lessen in numbers. Here's a sign that reversed the trend and by its stark message has cut down accidents at this particular Alabama highway intersection. A number of conventional warning signs precede it. In a check made at the time this photograph was taken of 50 cars only five were slowed down by conventional signs preceding this one; of the remaining 45 motorists only two failed to slow down measurably upon viewing the above sign.

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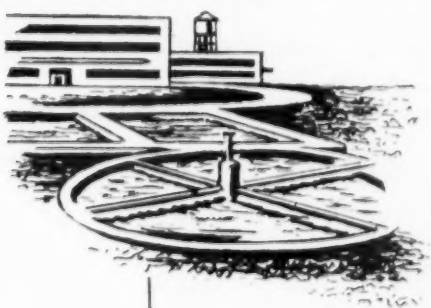

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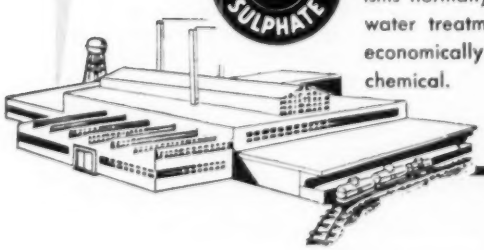

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Zoning is another municipal weapon; the development or redevelopment of land along streets determines the amount and type of traffic on those streets. The city should, therefore, re-examine its zoning ordinances to see how much it is contributing to traffic congestion.

6. Encourage mass transportation.—The alternative to a volume of private cars clogging streets is mass transportation. Subways, buses, trolley coaches and streetcars can carry more people faster if they have the room and they can provide better service. Communities can help by lowering ancient taxes on mass transit companies, make higher fares possible where needed, provide more street facilities where these vehicles can move more swiftly without delays due to private car congestion.

Fare raises are not always necessary, but zone fares should be encouraged. Lower fares for shorter trips would attract more passengers. Express routes, with city-provided parking lots at stops outside the downtown area, would do much to better service and attract more travelers. With improved mass transit service, fewer private cars would be on streets.

7. Ban curb parking.—When 20 cars park along a 200-foot city block—ten on each side—they can block the passage of 500 vehicles, cutting average traffic flow from 1,200 cars an hour to 700. Curb space thus becomes very expensive, and the usual parking meter price of five cents an hour becomes ridiculous. Widening a busy street to permit out-of-traffic curb parking can cost from *$10,000 to $50,000 per parking space.*

The solution: Ban curb parking entirely on busy downtown streets; limit it to one side if a total ban is impossible; put a price on it reflective of its value. If off-street parking, which must cost at least 15 cents an hour, is to be encouraged, why set up competition for it by charging only five cents at the curb?

8. Divert all-day parking.—Parking in the downtown district is a two-sided problem: (1) the worker wants to drive downtown and park his car all day; (2) the shopper wants parking space for a short time later in the day. Cheap all-day parking a reasonable distance (four blocks) from congested areas should be provided for downtown workers.

9. Garages—preferably private. — Off-street parking facilities are of prime importance in solving downtown congestion, particularly if curbside parking is to be limited. Privately built and operated garages are considered preferable to those provided by the city. Such private accomplishments as the new ramp-type garage built by the Hecht Co. in Washington and the Park'n Shop system in Allentown, Pa.—in cooperation with the city—have proven most successful.

10. Garages—build them for less. Whether privately-built or city-built, garages will not answer the traffic problem if they cost too much to construct and operate. A first-class garage has been built in Los Angeles at a cost of $900 per car. A cost of $1,200 per car will still return a good profit; when the cost hits the $3,000 mark, profits will be negligible or rates exhorbitant. The city can help cut costs in other ways besides low taxes; as by eliminating unnecessary and costly building requirements.

Private investors can cut costs by driving the hardest bargains, drawing the best plans and installing retail stores on ground floors to increase revenue.

11. Build better roads.—A system of

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express highways—with limited access, high speed design and facilities for mass transit vehicles—should circle all downtown areas. Radial spokes would provide quick access to specific points within the downtown section and the "loop" feature would encourage by-passing the center of the city. Building should progress from the outer edges of a metropolitan district and work toward the center. As ease of transport is established in the suburbs, decentralization will attract downtown firms, making it easier finally to redevelop the center of the city.

12. How you can help.—No doubt all agree that these things must be done eventually. But the need is now and you can aid by joining with businessmen to help solve present critical traffic problems. If you have suggestions for improvements, make them—to your civic organization, to your city officials, or to your local newspapers.

• • •

Mercury Vapor Lighting Reduces Traffic Accidents

According to a survey reported by the Jefferson Electric Company, traffic accidents have been cut an average of 35 percent during the past five years by seven major cities in those areas illuminated by mercury vapor lighting. The major cities and the percentage in accident reduction are: Des Moines 90 percent; Richmond 47 percent; Dallas 36 percent; Cheyenne 34 percent; Denver 18 percent; Reno 15 percent; and Atlanta 4 percent. None of the 65 cities covered by the survey reported any increase in either accidents or crime in the areas illuminated; about two-thirds of the 65 cities use this method of lighting and some of the others are planning to install it on a test basis.

• • •

Starting, Operating and Stopping A Water Plant

The superintendent of the Waverly, Ill., water plant, Joe Hawkins, remembering his experiences when first learning to operate his plant, has a complete set of typewritten instructions for starting the plant, operating, and shutting the plant down. To go with the instructions, he has attached a numbered metal tag to each valve and switch, the numbers corresponding to those on the type-written instructions. "Joe" feels that the procedure, as outlined, is clear enough that a stranger coming into the plant could operate it in an emergency. This could be a good "Civil Defense" measure. Illinois "Over the Spillway."

• • •

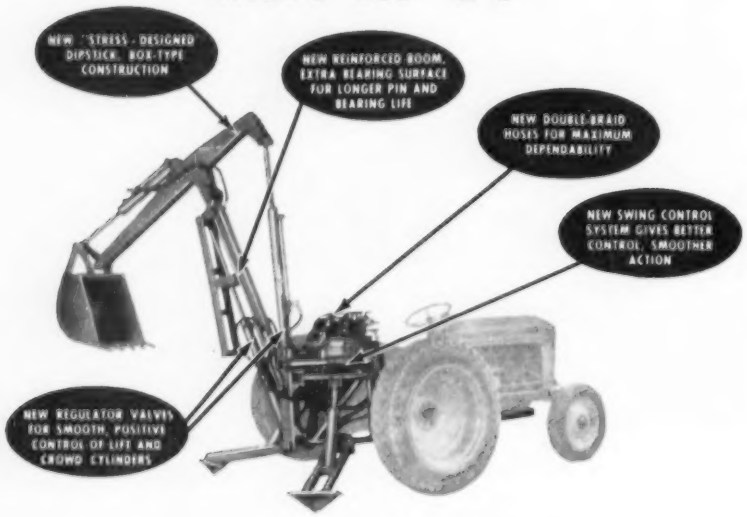
Tax Exempt Property in Milwaukee

JOHN E. HUBEL

THE problem of obtaining payment for at least a part of the services rendered by cities to tax exempt organizations is a common one. A special committee has been formed recently in Milwaukee, Wisconsin, to study the problem and attempt to reach some sort of solution. It is probable that legislative action and approval will be needed.

The tax exempt property in the City of Milwaukee as listed for the year ending December 31, 1952, totalled $337,188,110 of which $204,434,630 represented property owned by the city itself. The Federal Government, State of Wisconsin and Milwaukee County accounted for $53,425,330. This leaves $79,328,150 for non-governmental agencies. By far the greater portion of this is property owned by churches, private educational institutions and benevo-

New reasons why.. Sherman Power Diggers give you More for '54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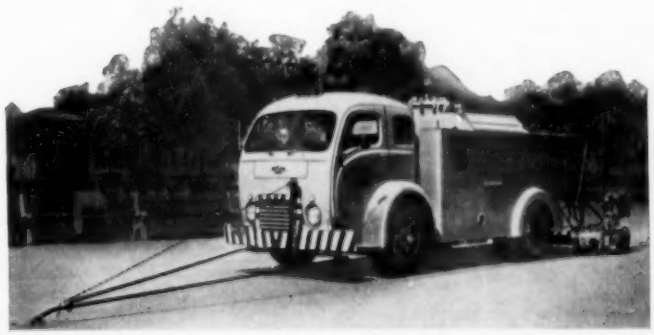
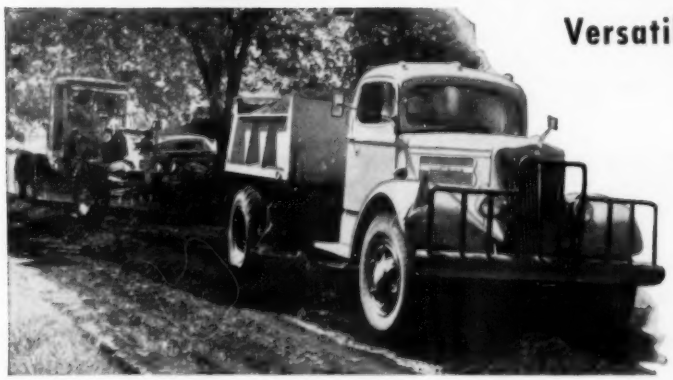
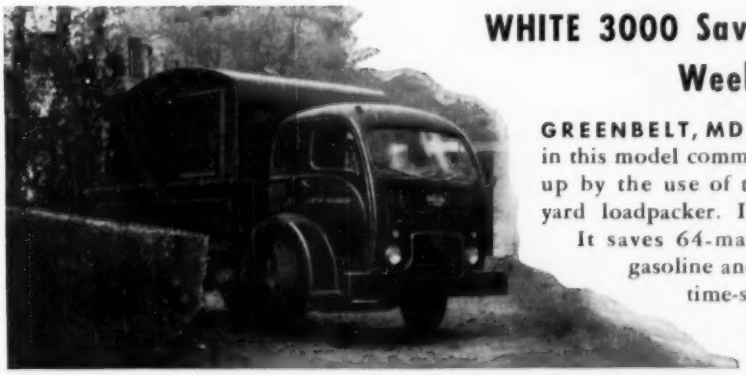




Versatile WHITE "Roadscraper" Does Double Duty Service

TULSA—Versatility of White Trucks is demonstrated in this street repair unit in service in Tulsa. This White is one of five with 3½ yard hydraulic dump body and a 10-foot understanding scraper blade. Whites can be tailored to exact operating needs with definite advantages of efficiency and performance.



WHITE 3000 Saves 64-Man Hours Per Week in Refuse Collection

GREENBELT, MD.—Residential refuse collection in this model community of 7,000 has been speeded up by the use of this White 3000 with 15 cubic yard loadpacker. It replaced two nine-yard units. It saves 64-man hours a week and saves on gasoline and oil. Its maneuverability is a real time-saver in the narrow service courts and cul-de-sacs.

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lent institutions. About $70,000,000 is included in these classes.

One other complication in the Milwaukee tax problem is that the State of Wisconsin collects the tax on all private utilities and returns varying percentages to the city. The return is usually 65 percent, although in the case of terminal property it is 100 percent, Wisconsin Telephone Company 85 percent and steam railroads nothing. In 1952 the total amount returned to the city was $2,302,591.43.

• • •

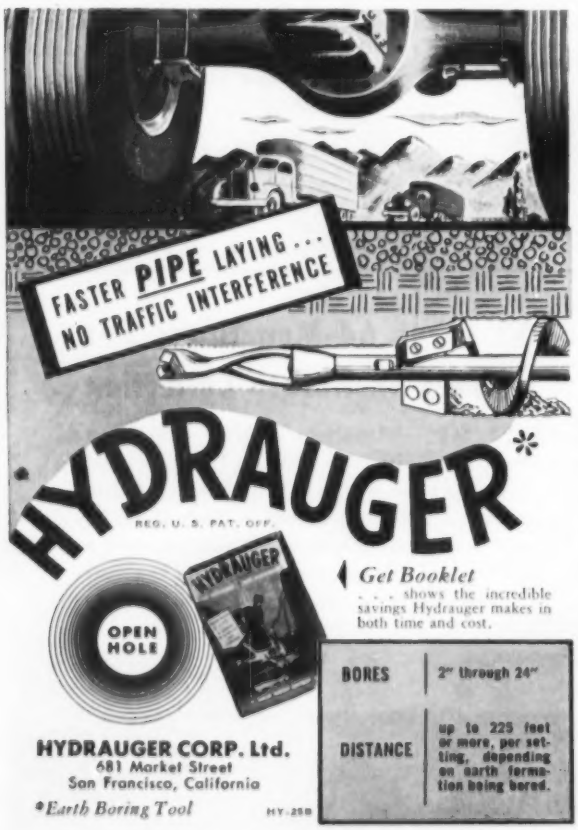
Red Reflector STOP Signs Stop More Drivers

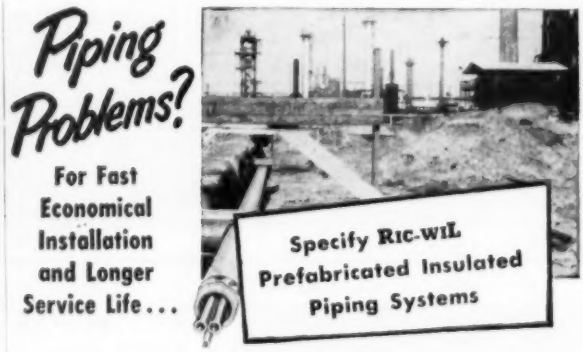
IN a series of tests, Florida highway engineers found that the new red reflective STOP sign stopped 2½ times more drivers than did the standard yellow. Since, according to the National Safety Council, 40 percent of all traffic fatalities in urban areas occur at intersections and also 12 percent of the fatalities in rural sections, any increase in stopping ability of the type of sign is important. In all, about one-half of all motor vehicle accidents occur at intersections.

● FLAME-RED signs shows up equally well at night or during day.

Red signs have been tried out for intersections in the past, but were found impractical for three principal reasons: (1) Red signs looked black at night and were thus almost invisible; (2) red paint formerly used was not durable enough for outdoor traffic sign use; and (3) red porcelain enamel, which met the above objection to some extent, was very costly.

Now a flame-red transparent color has been developed for reverse screening on silver reflective sheeting by Minnesota Mining & Manufacturing Co. The signs now made have an over-all red reflective background with white reflective letters. They can be seen clearly at a distance of 400 ft. when driving with low-beam headlights; and about a quarter of a mile away when using high beams. The red reflective sheet, which is said to be very durable, completely covers the face of the familiar octagonal sign and makes it all brightly visible in red.

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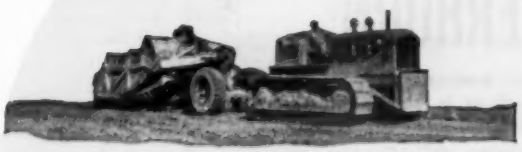

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K. C. FINCH,
City Manager, Anadarko, Okla.

SOME three years ago, on Feb. 15, 1950, we converted a 1,000-hp Fairbanks-Morse diesel engine to dual-fuel operation. A few months later, on Sept. 15, 1950, a 750-hp Bush Sulzer diesel was similarly converted to dual fuel operation. We now have operating data for a period of 40 months on our larger engine and for 34 months on the smaller engine. During this time we have saved just about 50 percent on our production costs.

In operation, the engines burn 93 percent natural gas and 7 percent fuel oil and they continue to operate on the diesel principle which is much more efficient than using full natural gas. In other words, the units produce practically the same amount of power on dual-fuel as on full diesel oil and we generate power at a saving of approximately 6 mills per kwh. During the past five years our fuel oil cost has ranged from 11.5 to 8.35 cents a gallon. Our average cost for natural gas has been 15.5 cents per 1,000 cubic feet.

Total production costs for the 1948-49 fiscal year were 2 cents per kwh as compared to 0.5 mills in 1952-53 fiscal year. Total power generated in 1948-49 was just over 4.5 million kwh, with a fuel cost of 9 mills per kwh, based on a total of $40,551; total operating costs were $89,558. In 1952-53, total power generated amounted to 5.52 million kwh, with a fuel cost of 3.3 mills per kwh and a total production cost of 9.5 mills per kwh, based on a total production cost of $58,473. In other words, with an increase in power produced of more than 20 percent, fuel costs dropped from $40,551 to $17,962. On the basis of 1948-49 production, there has been a gross saving of $169,533 in four years.

Over a 40-month period, from 2/15/50 to 6/30/53, fuel costs have averaged 6 mills per kwh. During these 40 months, the 1000-hp unit generated 12,020,932 kwh; and during the 34 months ending 6/30/53, the 750-hp unit generated 4,351,370 kwh. The fuel savings on the two units is estimated at $98,233.81. The cost of conversion was $22,000, so the net fuel saving over the period amounts to $76,233.81.

• • •

Snow Melting System Serves a 700-Ft. Street

Hillcrest Drive in Coshocton, O., has a 15 percent grade and in snow and ice times it isn't easy to navigate. Property owners and residents contributed the cost of constructing a snow melting system. Coils of wrought iron pipe were laid on top of the old pavement, which was then surfaced with 2 inches of black-top. Warm water, with anti-freeze, is circulated through the pipes to prevent the ice from forming and to melt snow.

The snow melting system cost $4680, or less than $335 per property owner, using about 4200 ft. of 1¼-inch pipe. The cost of the pavement was about half as much as for the heating system, bringing the total cost per property owner to $513. The cost of operation for the first season was only $116.40. An automatic control has been installed for the coming winter, using an electric eye beamed on a black plate. As soon as the plate is covered with snow, the heating system starts. Natural gas will also be used this winter, replacing fuel oil.

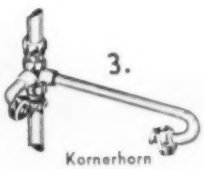
The system was designed by C. R. Philips of the James B. Clow Co. Coshocton plant.

For Setting Meters in Basements

EASY TO INSTALL

1. Cut supply line. Clamp not necessary but convenient

2. Add Connections



3. Kornerhorn in place

The Kornerhorn

In a vertical basement pipe, against the wall or in a corner, the Kornerhorn makes a most satisfactory meter setting. Installation is fast and economical as pipe threading is eliminated. Send for detailed information.

When Valves are Needed

Ford Kornerhorn valves installed on the supply side, or on both sides of the Kornerhorn add extra convenience and cleanliness when meters are changed.

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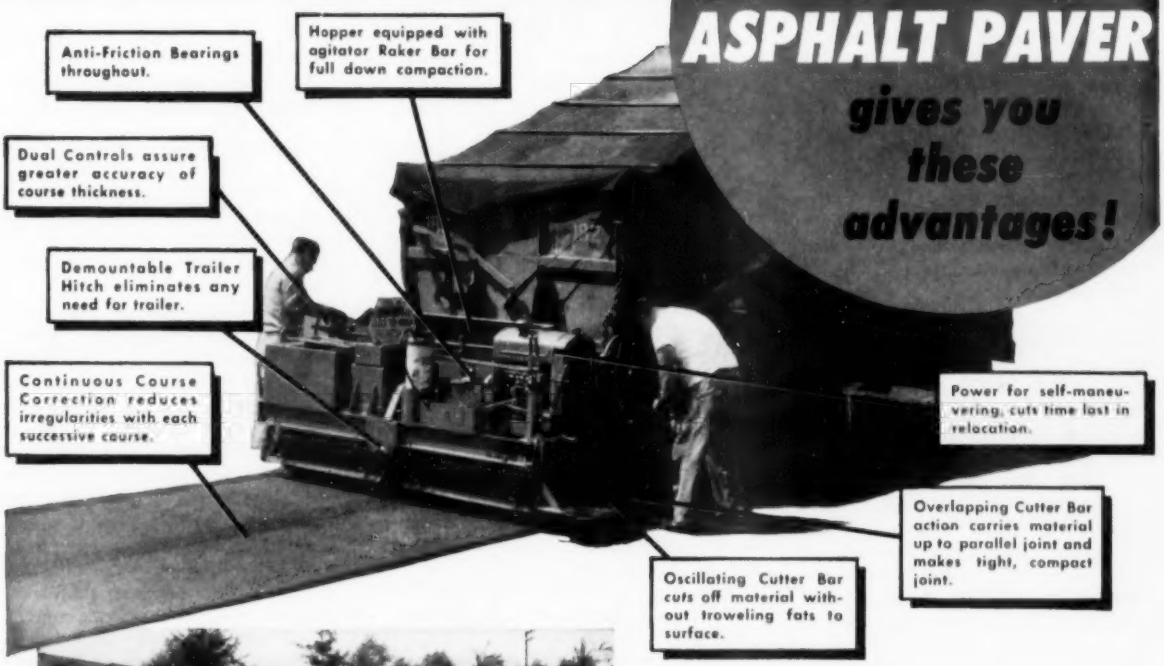
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Power for self-maneuvering, cuts time lost in relocation.
Overlapping Cutter Bar action carries material up to parallel joint and makes tight, compact joint.
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PUTTING DOWN ROADWAY IN A LARGE CHICAGO CEMETERY.

LAYING A PARKING LOT IN NEW JERSEY

HERE, for the first time, is a precision Black Top Paver in a small package! The advantages listed above can be had in no other machine of this type. These advantages combine to give you a better job on those parking lot, driveway and playground contracts. They mean faster spreading, less time lost in relocation and greater accuracy of control. Look over these and the other Adnun advantages. Ask for details and plan on the new Adnun Jr. Model 8 for non-specification work.

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Reclaiming Waste Water: Ground Water Pollution

(Continued from page 60)

were tested using the same method.

The permeability of surface soils in feet per day for the four plots was found to be as follows: A, 0.96; B, 0.89 (north) and 0.72 (south); C, 3.91; and D, 2.73 (north) and 2.89 (south).

Basin Construction: Test basins were 19 ft. in diameter; four were constructed initially and four later. Prior to construction, holes 38 ins. in diameter and 15 ft. deep were dug. Caissons of 36-in. corrugated galvanized iron pipe, with access windows at 1, 2, 4, 7, 10 and 13 ft. levels, were placed in the holes and the area around them was carefully backfilled. Joints in the top 5 ft. were welded. Ladders and shelves were built into each well; and lateral tunnels were dug at each access window in which collecting pans were placed. The outside containing walls were made from 14-gauge metal sheets, set into trenches and extending 14 ins. into the ground. The access shafts and the walls were mounded to prevent seepage or lateral flow.

Operating Procedure: The method of operation was to flood a basin to a depth of at least 6 ins. and record the liquid surface elevation by means of a hook gauge set in a stilling well. Liquid was added as needed to maintain the 6-inch depth. Samples were collected from each sampling point about once a week, using standard procedures. Assessment of the bacteriological purity of the water was based on the most probable numbers of coliform group organisms since other methods appeared to be either of little significance or did not apply because of the very low concentration of fecal streptococci.

At the 4-ft. depth MPN per 100 ml for the four basins were as follows: A—2.1 when final effluent was applied; 0.6 with settled sewage. B—0.5 with final effluent, 0 with settled sewage. C—2.0 with final effluent. D—reports not available for 4-ft. depth; 0.2 with final effluent at 1 ft.; 0 at 7 ft.

The gross percolation was the difference between the daily liquid level readings as measured by the back gage. A correction factor was applied for daily net rainfall or evaporation to obtain the daily net percolation.

Quantitative chemical changes in the liquid during percolation were few. Calcium, magnesium and sodium remained relatively constant to a depth of 13 ft. Potassium was decreased about 50 percent in passing through 13 ft. of soil. Ammonia was removed within 4 ft. Chlorides remained unchanged. Sulfates increased about 40 percent. Bicarbonate also increased; and nitrate by several hundred percent. Phosphate disappeared in the first foot of travel.

BOD averaged 2.49 ppm at a 1-ft. depth, 1.15 ppm at 4 ft. and 1.66 at 13 ft. DO varied with the depth rather unexpectedly. After decreasing to a minimum at a depth of 2 ft.—the zone most active biologically—DO rose at the 3 or 4 ft. depth and then again fell off.

Percolation: Higher first-day percolation rates were obtained in the summer and fall when the surface moisture content was about 5 percent, than in the winter and spring when it seldom was less than 18 percent. Drying of the plots below the permanent wilting point (at Lodi about 8 percent) was beneficial. Spading produced a high first-day rate.

Percolation rate curves from spreading fresh water, final effluent and settled sewage are all similar, but the rate of percolation of settled sewage is higher. This is considered to be due to organic matter in the sewage which tends to modify somewhat the character of the soil, and to the higher content of cations.

The surface of one basin was covered with sand, resulting in a higher percolation rate over a longer period of time; but it was shown that the sand must be replaced or cleaned often. Krilium, a soil conditioner, was applied at the rate of one pound per 100 sq. ft., but no beneficial result was obtained. (On another type of soil, addition of Krilium was beneficial.)

TABLE 1—SOIL TYPES AND CLASSIFICATIONS

Basin Number	Unif. Coeff.	Effect. Size	Clay-% <0.002mm	Silt-% 0.002-0.050mm	Sand-% >0.050mm
A	42.1	0.0422	7.0	10.5	82.5
B	108.0	0.0306	7.8	14.0	78.2
C	51.0	0.0541	7.2	20.3	72.5
D	54.5	0.0055	9.5	26.0	74.5

Nuisance Studies

Odors: During the course of the spreading operation a daily record was kept of the odors associated with each basin. Sewage odors, such as the odor of hydrogen sulfide, were only occasionally observed. There seemed to be little difference in odor production between basins spread with final effluent and with settled sewage.

Odor complaints were never received from the sewage plant operator who maintained a residence directly opposite and about 50 feet from the spreading area. From a private residence which was located about 200 yards from the spreading basins but which was in the direction of the prevailing winds from the basins, no complaints were received.

It appears likely that a large scale spreading operation, intermittently operated, may produce sufficient odor problems to warrant control. Part of the odor may arise from algae. Copper sulfate may be used to control algae. Chlorine may also be used for algae control. Furthermore, the chlorine will act as a disinfecting agent, thereby reducing still more the possibility of ground water contamination.

It must be pointed out that the prevention of algae growth will result in lowered concentrations of surface dissolved oxygen. The benefit derived from the algae as an oxygen source is probably more important than the possible odor nuisance. For that reason, if local conditions are suitable, the algae should be permitted to develop.

Insects: The spreading basins acted as mosquito breeding grounds. Surveys made by the Northern San Joaquin County Mosquito Abatement District reported the presence of several mosquito species in appreciable number. The species were *Culex pipiens*, *C stigmatosoma* and *C. tarsalis*.

During the summer of 1950 an attempt was made to control mosquito breeding by the use of mosquito fish, *Gambusia affinis*. Although the fish were able to reduce the number of mosquitoes the difficulty of handling the fish in intermittently operated basins and the unsuitability of highly polluted waters as an environment for them made this method of control unsatisfactory.

What's a Wholesaler's Salesman?

SOMEWHERE in that golden land "buying men" inhabit—between the first blush of interest and the final inward satisfaction of goods well purchased, there dwells a man with a purpose—a salesman—a wholesaler's salesman.

This wholesaler's salesman is a composite of many things—a well balanced being who daily displays more enthusiasm, tempered with logic; deeper humility in harmony with personal aggressiveness; a greater friendliness throughout a longer day than anyone else on earth.

It doesn't matter much what he looks like or what he sells—a short man selling steel, a tall man selling books—one thing is for sure—he shares with all his brothers a common and demanding creed—to appear his best in the eyes of three people—his customers, himself, and his boss—in that order.

A wholesaler's salesman is a hard-working sportsman-like ball of energy bent upon the destruction of all things, real or imaginary, which stand in the path of consummating a well-planned sale or the creation of a happy and enduring customer-salesman relationship.

About closing the tough ones—he cries "Cinch" to his boss; "Luck" to his wife; but deep inside his true feelings pour out—the warm, good sense of pride that comes to a man by having done a job through plain hard work.

We all know that products are of little worth in the hands of their manufacturers. To have the success and magnitude of business as we know it today, the goods of one manufacturer must be combined, adapted and modified with goods from a second producer, and so on, in a never ending pattern. Products must move—goods must be sold. That's why wholesaler's salesmen are perhaps, collectively, the most important people we have. They sell more goods, create more wealth and exert a greater force upon the total economic greatness of this country than anyone imagines.

Wholesaler's salesmen are the wonder men of business—They drive more miles; eat more hurried meals; get fewer ulcers; meet more people; and remember names longer than anyone we know.

Wholesaler's salesmen are people who, when golfing with customers, should lose graciously by at least seven strokes; should enjoy catching trains on Sunday; and never be upset by shipments long overdue—A hero with a sales talk—The blood and thunder men of American business—That's today's wholesaler's salesmen.

When the last sale is made and life has resolved itself to comfortable, retired living; who among us has had a wider life—a life filled to the very brim with more of the stuff of richness—personal satisfaction, competitive living, constant challenge and rich, soul-satisfying reward—the wholesaler's salesman.

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Spraying with DDT in various formulations was tried. The simplest method of mosquito control was by the use of "toss-its," small gelatin-like balls, which contain DDT with a water emulsifying agent. The "toss-its" were thrown into the basins and as the covering material dissolved, the DDT was liberated.

All of the work on mosquito control was done by representatives of the Northern San Joaquin County Mosquito Abatement District.

Mosquito breeding, unlike fly breeding, presents a real public health danger. The presence of conditions conducive to the development of mosquitoes may possibly lead to the multiplication of malarial mosquitoes (but this is unlikely). Although no anopheline or malarial mosquitoes were collected, under other spreading conditions they might be found. Fortunately, primary malaria is rarely found in California, and it may be suggested that spreading operations will lead to very few new cases, if any at all.

More important than the danger from malaria is that from encephalitis. A vector in the transmission of encephalitis is the mosquito, particularly *Culex tarsalis*. The presence of this species in and around the spreading basins indicates the existence of an unsafe situation. This is particularly true in California where mosquitoes have been implicated frequently in the transmission of both western equine and St. Louis encephalitis.

To summarize, insect nuisances are unlikely in spreading areas in spite of the presence of numerous insect species. Insect menaces to public health, as mosquitoes, are to be expected unless adequate mosquito control operations are undertaken.

Acknowledgements

The study was made under the general direction of Professor Harold B. Gotaas, Chairman, Division of Civil Engineering and Irrigation of the University. Vinton W. Bacon, as Assistant Director of the Sanitary Engineering Research Project, developed and guided the study at its inception, with the assistance of Dr. Jerome, F. Thomas, and Raymond V. Stone, who later succeeded Mr. Bacon as assistant director. Professor Harvey F. Ludwig directed a considerable portion of the work before joining the staff of the U. S. Public Health Service. Throughout the final eighteen months of the study Arnold E. Greenberg was responsible for the conduct of the field work.

• • •

Sewage Effluent as a Beverage

"At the opening ceremony, Mayor Smith pressed a button to set the disposal works into operation and then drank a glass of purified sewage water to prove the purity of the liquid after it had passed through the purification plant." This is a quotation from a description, in the South African Municipal Magazine, of the opening of a new sewage treatment works at Uitenhage, South Africa. The plant is a very complete one, containing Dorr clarifiers, biofilters, Dorr humus clarifier, slow sand filters, a chlorinator and a contact pond; while the sludge is digested and dried on beds, and the gas is used for heating the primary digester. To pass through this plant requires more than a few minutes, and we wonder what Mayor Smith really drank, after he had "set the disposal works into operation." Or was this ceremony a mere formality, the plant having been in operation for several days or weeks beforehand?

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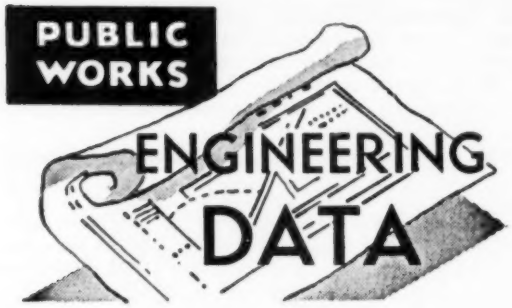

Costs of Garbage, Rubbish and Ash Collection

Costs of collecting garbage and rubbish are reported in the 1952 annual report of the City of Easton, Pa. During 1952, 8,183.7 tons of garbage and rubbish were collected. Costs per ton were: labor in collecting, $6.346; trucks, $0.368; handling at incinerator, $1.515; supervision $0.255; and maintenance and operation, $0.287. Total cost per ton collected amounted to $8.789. The cost of collection of 6,147 tons of ashes amounted to $5.89 per ton, of which $5.099 was for collection labor, $0.451 for trucks and $0.340 for supervision.

Prepares Disaster Plan to Meet Varied Emergencies

Lansing, Michigan, according to Public Management, is developing a master disaster plan to meet emergencies such as the tornado which went through the Flint, Michigan, area. The city will establish a definite plan of co-operation among various public and private agencies for rescue work, policing, medical treatment, removal of victims to hospitals, electric power and communications, and other services. Demolition squads and rescue crews will be trained by the fire and police department. Working in the development of the master disaster plan are the heads of Lansing hospitals, medical organizations, public and private utilities, ambulance operators, the Red Cross, various city departments including fire and police, and the owners of heavy motor equipment who will be organized to clean up debris.

Land Area Requirements for Composting Refuse

On the basis of average values observed in various California cities, the land area required for composting refuse from a city of 100,000 population is estimated as follows in a bulletin issued by the Sanitary Engineering Research Project of the University of California.

With a population of 100,000 and a refuse production of 2 lbs. per person per day, the total daily production will be 100 tons, of which the compostable fraction will be 66 tons. Assuming a refuse weight of 325 lbs. per cu. yd., this will amount to about 410 cu. yds. per day. With a windrow dimension of 5.5 ft. high, a 10-ft. base width and a 6-ft. top width, providing a cross-sectional volume of about 5 sq. yds., there will be required a windrow about 250 ft. long for each day of operation.

If the maximum composting period is 20 days and there are 30-ft. interruptions between daily windrows and 15-ft. spacing between each set of windrows, the total area required will be about 140,000 sq. ft., or 3.2 acres. With a 100 percent factor

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NON-CLOG SCREENLESS SEWAGE PUMP

WITH THE BLADELESS IMPELLER

Pumps ALL Sewage

Household Sewage — Industrial Sewage — Even Rags

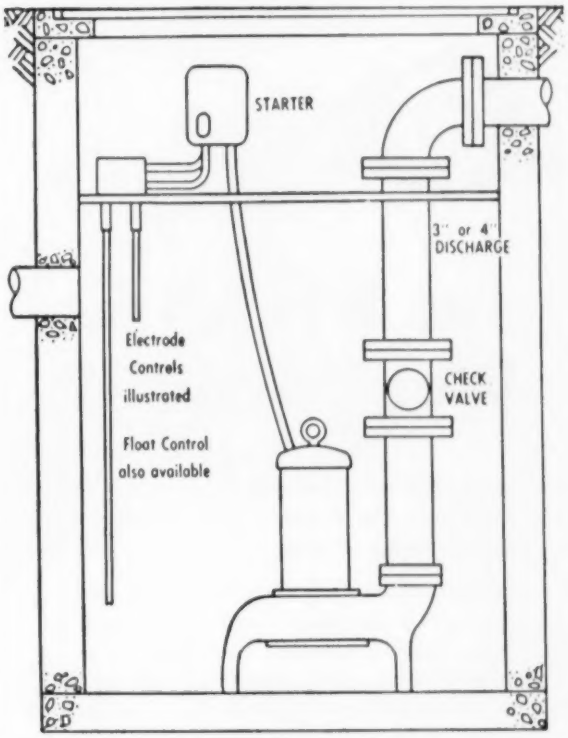

Illustration shows Underground Lift Station with Submersible Pump in wet pit. Requires NO PUMP HOUSE to mar the landscape. Duplex units furnished with alternators.

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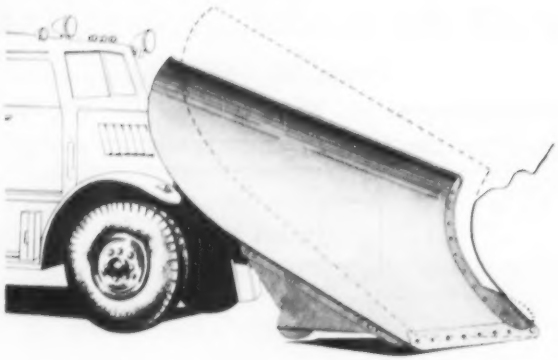
NO MATTER HOW WET THE SNOW



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No matter how hard they hit or how wet the snow—the Frink V-Type Sno-Plows will not wedge or stick.

When bucking deep snow the weight and pressure of the snow causes the patented Heel Chain Suspension to compress the forward truck springs more than normally. When the forward motion stops, the truck springs, relieved of this pressure, force the heel of the plow up and forward (as shown by dotted line). The plow then resettles into normal position again—thus freeing the plow. This—plus the pivoted Drive bars—positively eliminates wedging.

Frink Reversible Type, One-Way Type, V-Type Sno-Plows and the Frink Roto-Broom are interchangeable on the same truck attachment.

For further information on this Sno-Plow write for catalog to nearest address, Box P.W. 541

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of safety (which seems well to assume), the required area will be 6.4 acres. An allowance of at least two acres should be made for buildings, yard area and general storage. On this basis, the total desirable area is estimated at 8 to 10 acres.

Pipe Finder Helps Locate Sewer Manholes, Valve Boxes and Pipe Lines

The Lakewood, N. J., Water Company also operates the sewer system. M. Steelman, Jr., is manager. During the past few years the Fisher M-Scope has been very valuable in locating manholes, valve boxes and pipe lines. Sewer stoppages require immediate attention and this finder has quickly located manholes which have been covered over by street surfacing.

Typhoid Fever in Maryland is Like Snakes in Ireland

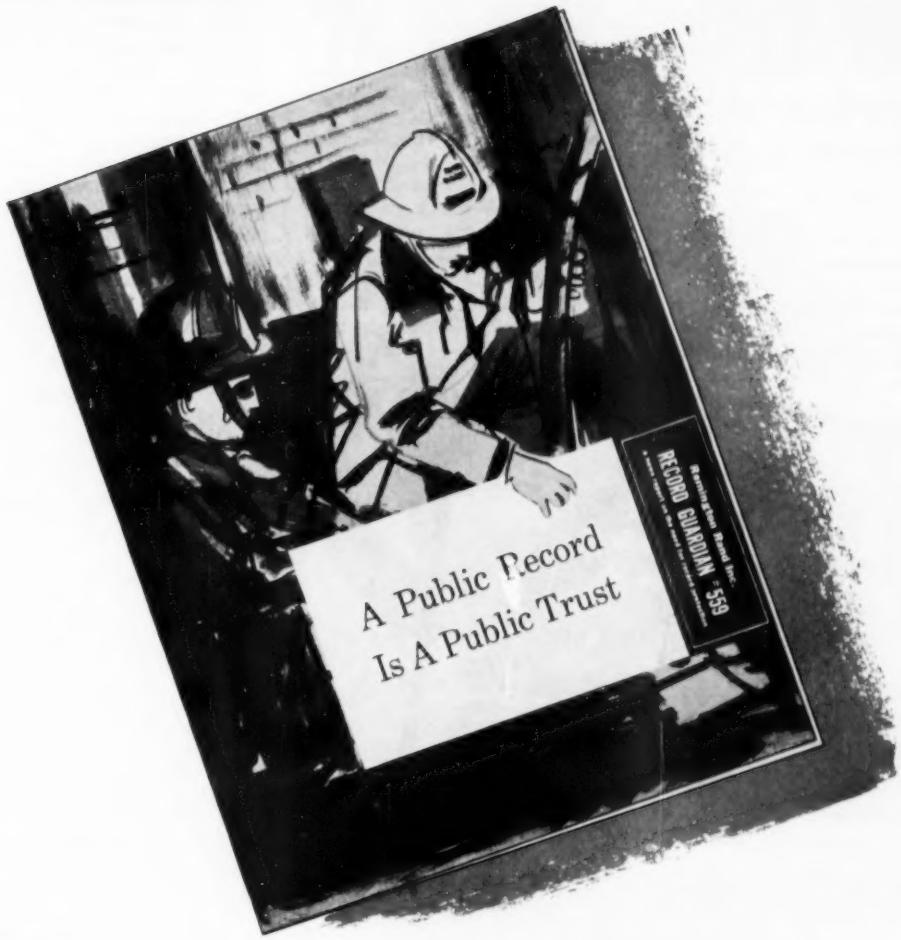
It is said that a writer of a book describing Ireland included a chapter on "Snakes in Ireland," which consisted solely of the words: "There are no snakes in Ireland." Similarly, there is no typhoid fever in Maryland; at least, there have been no deaths from typhoid since 1948; and not more than 0.2 per 100,000 in any year since 1943. Figures given by the State Board of Health for the years 1910 to date show a decline from 42.8 in 1910 to 10.5 in 1921, to 1.7 in 1936, to 0.2 in 1945, to 0.0 in 1949. This is a record the state's health authorities can certainly be proud of.

Construction Details of Asphalt Lining for an English Reservoir

Several reservoirs and canals in the United States have been lined with asphalt for waterproofing, but what is believed to be the first use of this in England has been completed recently for lining a cooling water basin 16 ft. deep. The banks were formed of sand, the ground in the locality consisting of sand to a depth of 100 ft. Interior and exterior slopes are 2½:1; the top of the bank is 5 ft. wide. The embankment was covered with 6 in. of ashes and consolidated with a vibrating roller. The bottom also was covered with ashes and consolidated with an 8-ton roller. Weed killer was applied over the entire area. Then a base course of stone-filled hot-rolled asphalt was laid and consolidated to a minimum thickness of 2 in. Cold bituminous emulsion was applied, and on this a carpet of hot sand-asphalt was laid and rolled to a minimum thickness of 1 in. The junction of the base with the slopes was curved to a radius of 30 ft., giving a maximum thickness of asphalt here of about 9 in.

What Fluoridation Costs: Less Than Ten Cents Per Person

Data collected by the Maryland State Department of Health, Division of Sanitary Engineering, shows costs of fluoridation as follows: Hagerstown, cost of equipment $4,100, per capita cost of chemical per year 4.1 cents; Washington Suburban Sanitary District, equipment cost $14,015, chemical cost per year 3.2 cents per capita; Bel Air, equipment cost $1,269, per capita cost of chemical 7 cents; Baltimore City, equipment cost $13,635, chemical costs 5 cents per person per year.



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For Record Guardian 559 shows you exactly what happened to city and county records in four recent fires—shows you too, how easy and how inexpensive it is to protect your records *before* fire strikes.

Remember, fire never gives warning. And city officials have even more responsibility than executives in private business to take all necessary precautions against loss of their records. Use the coupon—send for this factual booklet *today*.

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Now's the time to mail this month's Reader's Service card.

New Use for Florida Lime Rock

The State Road Department of Florida has recently adapted soft lime stone to a new use. Occurring in abundance through the central and southern parts of the state, it has been extensively used as a base course for bituminous surfaces, as an aggregate in pavement concrete and concrete blocks, as a stabilizer for sandy sub-grades, and to increase the alkalinity of soils.

The Department is now using it as a leveling course on old, distorted roads which otherwise would have to be torn up and re-shaped or built up, using high-priced bituminous concrete. The method used is simple. The existing surface is dampened; the rock spread, shaped and compacted in a practically dry state; and a bituminous prime applied before ravelling can start. It has been found that the rock will adhere perfectly even when "feathered out" and jobs as much as four years old have shown no cracking or slippage.

Florida limestone (Ocala formation) is received on the road in such condition that 97 percent must pass a 1¾-inch sieve.

Toll Roads Not the Entire Answer

Self-supporting turnpikes offer one partial solution to the traffic problem. They relieve traffic to some extent but they cannot be built everywhere as they require a high degree of traffic density to make them possible. Although it has been very successful the Pennsylvania Turnpike carries but 4 per cent of Pennsylvania's total east-west traffic.

These statements are from an address by E. L. Schmidt, Secretary of Highways of Pennsylvania.

• • •

Doc Symons

(*Continued from page* 16)

of Newark, N. J., says you can tell how long a folding rule is, or was, if you see only two numbers on it. Anyone want to tell me, which two numbers?

★ ★ ★

Long Time — Last spring when I was attending the Purdue Industrial Waste Conference, I noticed a number of old grads ranging the Union Bldg. halls, back for Alumni Day festivities. One in particular caught my attention at dinner one evening in the Chestnut Room. His badge carried a large, "Class of '82."—I asked the cashier about him. Yes—it was the Class of 1882—his name was Huston, and he is the only living member of that graduating class of 71 years ago, and the oldest living alumnus of Purdue; comes back every year. Been retired now for 21 years; retired on his fiftieth anniversary. Some said he was a former professor at Purdue, others that he still travelled extensively, taking cruises in the winter, but always coming back for Alumni Day.—Oh yes, he was 95 years old—and as spry as most of us at the meeting.—Wonder if Don Bloodgood, George (Green Bay) Martin, and I will be going back to Wisconsin for Homecoming in 1997.

★ ★ ★

News Notes from Brushy Bend—Activity in the grass roots areas (Brushy Bend) continues to grow apace—The N.W. Ohio Section AWWA, held a filter plant inspection on Oct. 29, at Fremont, Ohio, followed by a $2.00 steak dinner, with a talk by Paul Johnson, Proj. Engr. of Improvements at Fremont. —The Lower Hudson Valley Section of NYSIWA combined its Oct. 29 meeting with the formal opening and dedication of the Peekskill, N. Y. Sewage Treatment Works. J. Wilbur Irish, City Engineer, and

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Cleans clogged mains for about
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Guarantees 95% new main
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Clogged underground mains are terrifically expensive to own or operate! Every particle of scale and rust deposit cuts capacity, skyrockets your pumping and operating costs.

Now, you don't need to replace clogged mains. Flexible Pipe Cleaning Company can *clean* that stuffed up main—return it to guaranteed 95% efficiency—and AT A FRACTION OF REPLACEMENT COST. For example, new 10" steel line, 30" underground costs at least $6.00 a foot wrapped and laid. Tees and crosses are extra. Flexible can *clean* that SAME LINE FOR ABOUT 18¢ PER FOOT *—or 1/30th the cost of replacement!*

How much to clean your clogged mains? Send for our Preliminary Job Cost Estimate form. Take five minutes to complete this form and return it to us. We'll give you a free estimate on the cost of cleaning your pipe—stacked, stored or underground.

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Thos. M. Riddick, Cons. Engr. were hosts. "A light collation of 'spirits' was served by the contractor at the plant."

The Central Ohio Section of the Ohio Sew. & Ind. Was. Treat. Conf. held its annual meeting at Westerville, Ohio, on Nov. 5, with an afternoon plant inspection and dinner at the Otterbein College Dining Hall. Kilgore's Chemist, Hugh McManus, talked. —Nov. 6 was the date of the first meeting of the North Jersey Water Conference. Water works movies provided the entertainment and Program Chairman, Harry Lendall, announced the schedule and topics for the ten meetings this season. They always meet at the YMCA in Paterson, N. J.

"Reuse of Waste Waters and Effluents" was the topic for discussion at the Nov. 18th meeting of the Metropolitan (NYC) Water & Wastes Society.—The Interstate Commission on the Potomac River Basin held its annual Industrial Waste Forum at Hagerstown, Md. on Nov. 19.—Two days before Thanksgiving, the Metropolitan Section of NYSIWA held its annual business meeting and heard papers by Al Sawyer (of Hazen and Sawyer, Cons. Engrs.) on "Water and Sewage in Liberia" and by A. H. Chasick, NYC Dept. of Pub. Wks., on "Activated Aeration."—On Dec. 3, Passaic County (N.J.) Engrs. Soc. honored Lou (Transite Pipe) Frazza with a testimonial dinner. At Lou's request proceeds of the dinner will be allotted for aid to some engineering student in need of financial help.—The Third Annual Water and Sewage Symposium sponsored by Louisiana State University Extension Division was held on Dec. 14-15.

★ ★ ★

Right The First Time — At the ASCE Convention in New York in October, Lou Howson, Cons. Engr. of Chicago, was presenting the various awardees to the President for their awards. When he came to Ralph Stone and W. F. Garber, who were to receive the Sanitary Engineering Division's Rudolph Hering Award, Howson said, "These men are engaged in sanitary engineering, which is a *wild* field.—I mean—a wide field. . ." From the laughter, the audience must have thought he was right the first time.

★ ★ ★

Famous Last Words — "Start planning now for the Seattle Convention of AWWA in May."

V. T. Y.—Doc Symons

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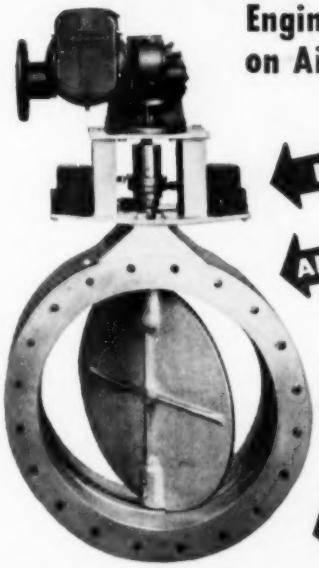

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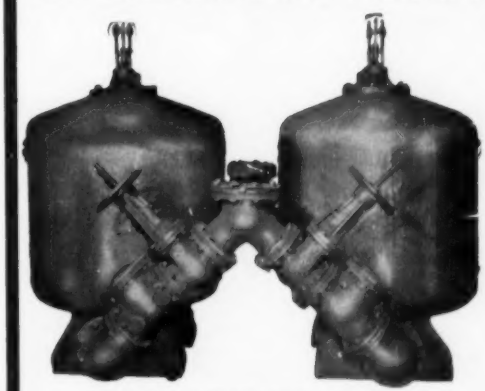

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A Low-Cost Pumping Station

Pleasantville, N. Y., with a consumption of 500,000 gpd has replaced a 50-year-old barn-like wooden pumping station with a fire-proof one 20% larger than the old one to house two electrically driven pumps. The pumps and suction and discharge lines were left as they were and continued in operation while the new station was being constructed around the old one. The new building covers 2440 sq. ft. and includes room for expansion of equipment, and a meter testing and repair shop, a garage and chlorinator room. Every effort was made to minimize construction and maintenance costs. Walls are of light colored concrete blocks. The ceiling is of pre-cast concrete planks. Exterior sheet metal work is lead-coated copper. For appearance, the center unit is faced with red brick and includes an entrance porch with round steel columns, flagstone floor and aluminum lettering on one wall. Windows, steel members and garage doors are painted marine blue. The total bid price was $30,357.

"An Architect Designs a New Pumping Station." By Gerson T. Hirsch, Architect. *PUBLIC WORKS*, December.

Rain Making In Texas

Because of a critical water shortage in Texas, in 1952, a commercial cloud seeder was engaged to endeavor to produce precipitation on the Dallas watershed. Operations began Nov 2, 1952 and ended May 22, 1953, during which time 15 ground generators were operated. Rain visited other parts of the state; the increase above normal was 363% on the Dallas watershed, but was so small as to be negligible on the other areas. The qualified commercial cloud seeder "operates moving cloud masses, associated with migratory storm systems, in such a way that the seeded segment of the cloud system lies continuously over his target area." An increasing number of successful operations of the type described seems to justify confidence in the potential value of cloud seeding. Research and experiments are aimed not only to increase precipitation but to improve the targeting of results.

"Cloud-Seeding Operations at Dallas." By Irving P. Krick, Pres. Water Resources Development Corp. *Journal AWWA*, November.

Establishing Rates For Fire Protection

Investigation by the Factory Mutual Eng. Div. indicates that as many as 66% of the water utilities in the United States and 35% of those in Canada receive no direct payment for fire protection service from the municipalities. The subject has been studied by a joint committee of the ASCE and of the American Bar Ass'n., and by a committee of the AWWA. The latter is still in progress. They have considered three general methods. 1) To apportion the fire protection costs on the relation that the fixed and operating costs of a system reserved for fire only would bear to the combined costs of separate systems for fire and normal use. 2) To apportion the total fixed costs of the works on the direct ratio of the fire demand to the total demand for fire and normal use and to include only incremental operating costs. 3) To allocate to fire protection only the additional capital and operating costs necessitated by that service. The third method is preferred by the joint committee. A procedure for using the third method is outlined, in which the essential parts of a water system are divided into 9 groups, and a study is made of the relative demands made on each group by maximum normal use and by the probable maximum requirements for fire protection; and a weighted combination of these is calculated.

"Additional-Cost Basis for Fire Service Rates." By Richard H. Ellis, Factory Mutual Eng. Div. *Journal AWWA*, November.

Power Shovel Speeds Up Pipe Line Work

The contract for laying 19,810 feet of water line for Aurora, Colorado, was awarded to C. W. Burks of Denver. Included in the total length of the conduit is 30-in. and 24-in. steel pipe and 16-in. and 12-in. cast iron pipe. The illustration shows a Lorain Self-Propelled hoe doubling as a crane to set one of the pipe sections. The pipe was picked up from behind the 10-ft. spoil bank, lifted over it, and set in place in the ditch. When used as a ⅝-yd. hoe, the shovel dug 2675 ft. of trench line measuring 40 ins. wide and 6 ft. deep. It moved approximately 750 yds. of clay per 8-hr. day traveling about 1,120 feet.

● **BACKHOE at work on pipe line.**

After the trench was completed the shovel was used as a lifting crane to handle the unloading and placing of pipe.

Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

THIS ILLUSTRATION showing the installation of U.S. mechanical joint pipe in a residential area is a typical scene. It could be either a water, gas or sewer line installed to furnish reliable utility service for present and future generations in the community.

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Swimming Pool Equipment

Durability, safety, good design and economy are important considerations in selecting swimming pool equipment. Conventional equipment for small pools is the one-meter diving unit; for larger pools, triple diving units with one three-meter and two one-meter units provide greater usefulness. These should be constructed of hot-dip galvanized steel pipe. For diving boards, the author recommends solid laminated construction using 12 sections of top grades of Douglas fir. Springboard units are ideal where official regulation diving units are not required. Regulation covering for diving boards and springboards is extra-heavy-duty cocoa matting. As floats for the lifeline, a new plastic, "Tenite", is recommended as far superior to wood or cork. Pool ladders should be entirely of non-rusting metal. Chairs with seats 6 ft. above the ground are desirable for lifeguards. There should be a cleaning tool on a 50-ft. suction hose and a pump unit. For larger pools, a diving mask to permit cleaning by a diver without draining the pool is recommended. Other equipment includes checking baskets and basket rack, beach umbrellas, rubber diving bricks and bicycle racks.

"Good Equipment for Swimming Pools." By Norman R. Miller, Am. Playground Device Co. *PUBLIC WORKS*, December.

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CLOW MECHANICAL JOINT BELL SPLIT SLEEVES

F-1205: For pipe sizes 3 to 16 in.

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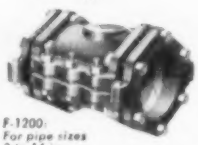

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A 3-Acre Reservoir Roof

Tucson, Ariz. is building a 20-million-gallon reservoir, excavated 10 ft. below the surface with embankment 14.5 ft. high; circular, with a top diameter of 414 ft. It will be lined with a 2½-in. layer of gunite. An interesting feature is the roof, which is of 24-gauge corrugated iron, resting on steel girders, which are supported by 148 reinforced concrete columns with vertical lengths up to 27 ft.

"King-Size Roof on New Reservoir.' *American City*, November.

Control of Secondary Contamination of Mains

Water from deep wells delivered to Honolulu's distribution system is free from contamination, and every effort is made to keep it so until it reaches the consumers. A few years ago coliform organisms appeared in new extensions and were traced to jute packing. This is no longer used; since 1947 asbestos rope has been the standard packing material. Also improvements were made in the procedure for disinfecting new main extensions, with special emphasis on adequate flushing. The minimum flushing velocity is 7 ft. per second, which is found to be necessary to remove dirt and foreign matter. After the water begins to come clear, flushing is continued until four complete "water turnovers" have taken place. Usually a gas chlorinator is used for disinfecting the larger mains and a hypochlorinator for the smaller and shorter ones, adjusted to provide a chlorine residual of 100-150 ppm. The minimum contact period is 24 hr. and may be longer. Then the main is flushed until the water tests free of chlorine, after which samples are taken for bacteriological examination. If any of five 10-ml. samples shows confirmed positive tests for coliforms, the disinfection process is repeated. When a main is repaired, the valves used for isolating the break are not closed completely but leave a slight flow of water from each direction toward the break to prevent a backflow of mud and contaminated water into

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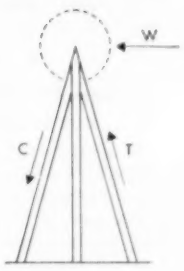

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the main. This is considered very important.

"Secondary Contamination Held Down in Honolulu System." By L. H. Herschler, Head, Water Distribution Div. *Water Works Engineering*, October.

Effect of Irrigation On Water Supplies

Irrigation water is generally returned in part to the stream from which it was drawn, and re-used several times; which results in a gradually increasing concentration of dissolved mineral matters in the stream. In certain cases cited, this increase has been 52% to 400%. In addition, fertilizers, detergents, insecticides and herbicides may be carried into the stream. Irrigation waters may therefore be considered as a source of stream pollution, making the waters objectionable for industrial and domestic purposes. Few laws, compacts or agreements have recognized this but more attention should be given to the matter. Moreover, irrigation return flows containing phosphates and inorganic nitrogen may increase the frequency of sieges of tastes and odors.

"Effect of Irrigation Runoff on Surface Water Supplies." A Panel Discussion; and "Relation of Irrigation Runoff to Tastes and Odors." By J. K. G. Silvey, North Texas State Coll. *Journal AWWA*, November.

Synthetic Detergents and Water Purification

During January and February 1953, very unusual difficulties were experienced in the operation of the softening plant of Osawatomie, Kans. A large floc formed but the settled water was cloudy and the basins were covered with several inches of floating material. At times only 10% of the coagulated material settled to the bottom. Filter runs were reduced from 100 hr. to 6 hr. The filtered water was colored and had a disagreeable taste and odor. Ottawa, 28 miles upstream, which took its supply from the same river had no such trouble, but did have foaming in its sewage treatment plant; and froth formed on the river below the plant outlet. Investigation indicated that detergents in the sewage continued almost undiminished (although diluted) through the sewage treatment plant, down the river and through the softening plant. The synthetic detergent content above Ottawa was 0.4 ppm; in Ottawa sewage, 44 ppm; in treated effluent, 39 ppm; in the river just below Ottawa, 6.6 ppm (dilution of 6 to 1 by the river); river at Osawatomie, 3.9 ppm; tap water at Osawatomie, 3.6 ppm. Different methods of treatment tried at Osawatomie showed best results obtained by dosages of 10 ppm of chlorine, 25 ppm of alum and 1 ppm activated silica; a good floc was obtained, and floating matter and taste and odor greatly reduced, but filter runs increased only to about 16 hr.

"Synthetic-Detergent Pollution in Kansas." Russell L. Culp and Howard A. Staltenberg, Kansas Bd. of Health. *Journal AWWA*, November.

Other Articles

Pneumatic chemical handling at the Batavia, N. Y. water treatment plant. "Water Costs Drop with Pneumatic Chemical Handling." By Nelson M. Fuller, Supt. American City, November.

Water main sterilization as practiced for 15 yr. at Springfield, Ill. "A Practical Program of Water-Main Sterilization." By S. T. Anderson, Supt. American City, November.

"**Control of Water Pressure** in Suburban Distribution Lines." By J. S. Williams, Automatic Control Co. Journal AWWA, November.

"**Centrifugal Pumps** for Municipal Water Works." By John Round, Jr., Goulds Pumps, Journal, Maine Water Utilities Ass'n. November.

"**A Dual-Fuel Engine** saves 37% in Fuel Cost at Kennett, Mo." Foresighted selection of engine cuts costs. By Max E. Veltzen, Supt. of Pub. Wks. PUBLIC WORKS, December.

"**Purification Plant Waste Disposal.**" A Committee Report. Journal AWWA, November.

Molecular filter membranes. "Technique of Bacterial Examination of Water with Molecular Filter Membranes." Report of a Task Group. Journal AWWA, November.

Open Air Reservoirs. Why they are desirable and some construction details. "AWWA Committee Report on Open-Air Reservoirs." Water Works Engineering, October.

Causes of taste and odors. The first of a series of articles "Newer Concepts of Tastes and Odors in Surface Water Supplies,' by J. K. G. Silvey, North Texas State College. Water & Sewage Works, November.

• • •

Soil Porosity Improved by Polyelectrolytes

A laboratory study of the effects which two soil conditioners have on the porosity of Florida soils has been underway since October, 1952, at the Sanitary Research Laboratory, College of Engineering, University of Florida. Seven soils have been ex-

amined to date, ranging from Material "B," a bankrun sand having an effective size of 0.205 mm, a uniformity coefficient of 2.18, and a clay content of less than one per cent, to Material "F," a very fine silty soil having an effective size of 0.197 mm, a uniformity coefficient of 2.19 and a clay content of approximately 10 per cent. Material "F" is common in sections of Alachua County and septic tank drain fields constructed in this material are prone to give trouble.

Laboratory tests conducted on 4-inch cylinders of Material "F" have shown that when 4.40 grams of one of the conditioners are mixed with a 1200-gram sample the volume of water which will pass through the material per minute is increased by 1200 per cent over the volume passing through a blank sample.

Studies with other conditioners are being made and a pilot plant study using a model septic tank and drain field installation is to be initiated in the near future.

• • •

South Africa Takes Steps To Discourage Unimproved Lots

To force owners of unimproved property either to build on it or sell it, the Town Council of Que Que, South Africa has increased the tax rate on land from 8 pence to 1 shilling to the pound, and reduced the rate on improvements from ½ penny to ⅛ penny. According to the South African Municipal Magazine, a councilman "presented strong evidence to show that Que Que's development was being held up by retention of valuable land in the central area. As these properties were appreciating in value because of the Council's work—not because of anything done by owners—the high rate on land would make the owners contribute more to the capital appreciation of their land. The Mayor said the proportion of property held up in Que Que was high enough to cause a serious setback to the town and the position must be remedied.

"Cllr. Harvey said the new rates would increase the Council's revenue by £6,500 annually, but the bulk of this would come from unimproved land and the small house-would increase the Council's rev-extent."

Seventy years ago Henry George urged in the United States that there be no tax on improvements, but that the only taxes imposed by cities be on the land alone—the "Single Tax" system.

Know Brookfield

(*Continued from page 54*)

commuters drove to the station on a particular morning, and where they parked. The only solution, therefore, was to establish parking limits that would discourage all commuter parking.

The four-hour parking recommendation was enacted into law three weeks after the first reading. No objectors showed up when the final vote was taken.

At present, Brookfield is in the process of shifting gears. For years, the village was on the verge of bankruptcy, but in 1945 a new administration took over and began the struggle for financial security. Since 1945, liabilities have been reduced from $738,500 to $264,000; the annual tax levy has been cut from $152,000 to $136,000; the police force has been increased 25 percent; and municipal salaries have been raised 36 percent.

"During the past eight years, we've had to cut expenses literally to the bone," Eash commented on one of the Sunday broadcasts recently. "But now Brookfield is entering a new phase of growth and activity, which will be concerned with the construction of needed public works."

The need for these public works is indicated by the fact that a large area at the north end of the village is without paved streets, and that in the southern portion of Brookfield, water and sewer mains are outmoded or nonexistent.

Much of this work will be financed through special assessments. Because of the fact that a few recalcitrant property owners can wreck plans for projects financed by this method, "Know Brookfield" will have an important role in these public works projects.

The job of selling what Brookfield's village manager calls, "the reasonableness of the board's actions," is a primary function of the broadcasts. No less important is the job of getting the taxpayer to understand the sometimes intricate, many times confusing, operations of his local government. Here is how the annual appropriation ordinance for street maintenance was explained on the "Know Brookfield" program:

"We are now planning maintenance work on our arterial streets totaling some $30,000 for the present fiscal year. This is an increase over previous years. The more motor fuel tax funds we can use

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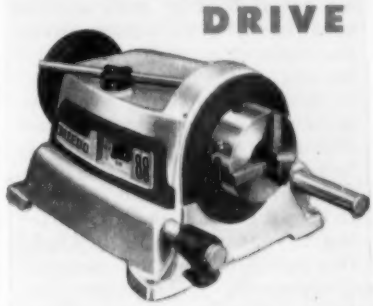

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for maintenance and construction on arterial streets, the more of our own corporate funds will be released for work on other streets in the village. With our tremendously rapid growth, with the increased use of our streets, the maintenance problem has become increasingly serious.

"This resolution (the appropriation ordinance), calls for, in addition to straight maintenance work, street cleaning; continued work on sewer cleaning; snow and ice removal during the winter; sealing the cracks in concrete streets with tar and sand; repairing curbs and gutters; and repairing manholes. Sometimes folks overlook the fact that a village is just like a big house—there is a lot of maintenance work that has to be done to keep it running and to keep the facilities functioning all the time."

Besides educating the taxpayer and answering his objections regarding official actions, "Know Brookfield" also serves as a kind of community conscience. A few weeks ago, for example, the village board approved erection of a traffic light after the matter had been under study for a year and a half. During that time, several Brookfield residents appeared at board meetings pleading the cause for the signal. They presented facts and figures that demolished the board's original fears that not enough traffic passed the intersection to justify the expense of a signal.

But after erection of the traffic light was approved, the property owners' group which had backed this project stopped coming to village board meetings. One Sunday, Eash mentioned the group by name, then pointed out that, for a year and a half, they had attended board meetings out of self interest, but now that matters not solely concerned with their own property were being discussed, they were absent.

At the next board meeting, several members of the property owners' group were present. One confessed to Eash, "You needled us on the Sunday program. That's why we came up."

"Know Brookfield" is not only concerned with explaining village actions. The program also tries to give its listeners a picture of the people responsible for these actions.

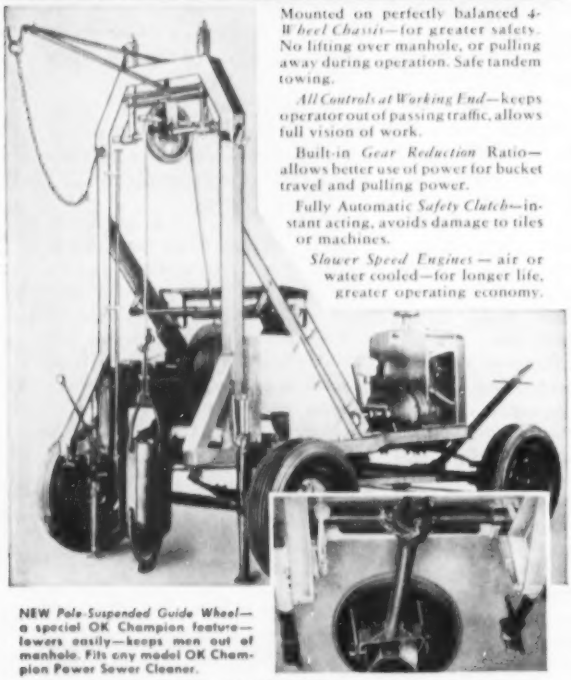
There are few broadcasts which don't mention some personal bit about one of the local officials. Here is a typical example:

"I don't know how many of you were present (at the board meeting last Monday night), but if you were you heard about Jake Dumelle (administrative assistant to Eash). He left last night and flew to Los Angeles and then is going up the coast a way to spend two weeks on a tour of naval duty."

Other village officials often appear on the program with Eash and together they discuss some village problem. Many times, when the village manager is out of town, the village president, Dan Kulie, takes over. Not long ago, Eash's secretary handled the show. Three months ago, a second program, called "Brookfield Reports," was launched on WTAQ. This show, also fifteen minutes long, is broadcast every Monday afternoon. Each week, one of the village employees is interviewed by Eash's assistant, Antone Ketterer. So far, the list has included the driver of the Brookfield refuse disposal truck, the switchboard operator at village hall, and the village cashier, among others.

Brookfield's village manager feels that this presentation of the "human side" of the village administration is a vital function of any municipal-

OK CHAMPION POWER SEWER CLEANERS



Mounted on perfectly balanced *4-Wheel Chassis*—for greater safety. No lifting over manhole, or pulling away during operation. Safe tandem towing.

All Controls at Working End—keeps operator out of passing traffic, allows full vision of work.

Built-in *Gear Reduction* Ratio—allows better use of power for bucket travel and pulling power.

Fully Automatic *Safety Clutch*—instant acting, avoids damage to tiles or machines.

Slower Speed Engines—air or water cooled—for longer life, greater operating economy.

NEW *Pole-Suspended Guide Wheel*—a special OK Champion feature—lowers easily—keeps men out of manhole. Fits any model OK Champion Power Sewer Cleaner.

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◀ ESTIMATES EXACT DEPTH
◀ SEPARATES PARALLEL PIPE, CABLE and CONDUIT

A crystal ball might be one way to locate buried pipe or cable at an excavation site. But . . . a *better, safer* and *more efficient* way is to use the new, improved Detectron "505" that accurately pinpoints the exact length, depth and location. *Stop guessing—and be sure!*

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ity's public relations program. "In most communities," he explains, "the average person thinks of his government as a kind of machine, made up of so many cogs. To dispel that misconception, we have to show that the 'machine' actually consists of individuals who have the same desire to do a good job and be respected for it as the voter does. There are probably at least a few villagers who are members of the naval reserve program. The announcement about Jake Dumelle showed them that a person like themselves was working in village hall. Almost any personal mention like that creates a bond between the public official and at least a few of the persons he is working for. It is in this way, I believe, that you build mutual respect and understanding between government and the people."

• • •

Sacramento Sewage

(*Continued from page 53*)

seventh. Testing the stress is done in two ways: by measuring the elongation, and by sonic testing. The latter method will be accomplished by leaving bridges of freely supported wire 22 ins. long at intervals. The stress-frequency relationship will be determined in advance. Then a simple frequency measurement will determine the stress of the wire wrapping.

After pre-stressing the construction joints between sectors are packed with mortar containing Embeco, an iron dust compound which prevents shrinkage. The tanks are then tested for water tightness by filling with water. This test completed, the tanks are given a one-inch coating of gunite over the wrapping.

It should be noted that the tank floor is troweled smooth and treated to prevent any bond between walls and floor. This must be done to permit the walls to move freely in the pre-stressing action.

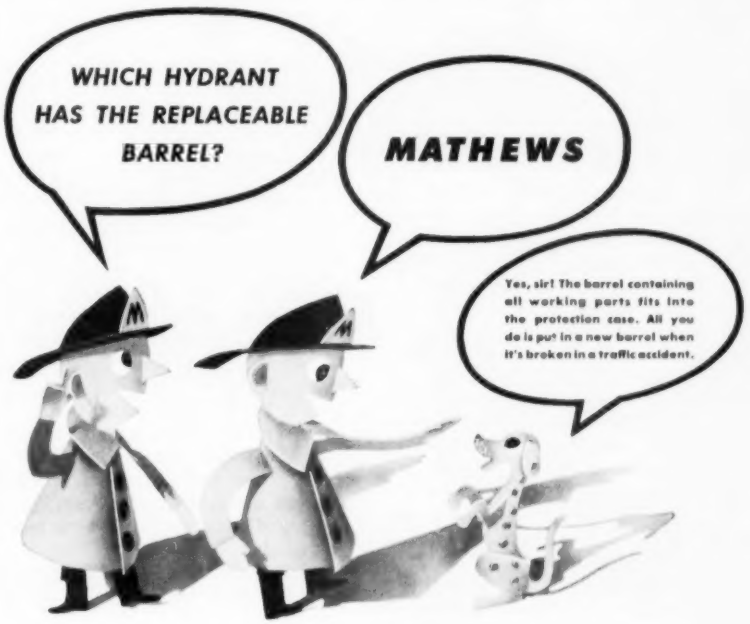
Paying for the Plant

Sacramento has financed the program in the usual way with bonds. It had to find a way to get paid on an equitable basis for the service extended to the outside areas. In the contracts with these areas Sacramento will lend the use of its credit by paying the entire cost of the project. Each area has been assigned a volumetric share in the capacity of the plant, and will repay its share of capital costs in the form of proportionate annual redemption payments on the bonds, plus interest. It will also pay its share of operating costs, based on measured contribution of raw sewage to the plant.

When these financial economics are added to those inherent in social and civic values, it becomes clear that the construction and operation of this large metropolitan plant will be more economical than the combined costs of several small ones which might not be able, individually, to take advantage of some of the more advanced practices of today.

But it was necessary to pin each area down to its own estimated share of the volume of sewage to be treated. Also, it had to be understood that the plant can be expanded, but that sewer mains through Sacramento cannot be.

Therefore, if any area needs more capacity in the future it must put up the necessary capital for expansion in any way that becomes feasible. The credit of the City of Sacramento will not be extended to finance such expansion. The limits of expansion, as everywhere else, are the limits of economics in practical engineering.


WHICH HYDRANT HAS THE REPLACEABLE BARREL?
MATHEWS
Yes, sir! The barrel containing all working parts fits into the protection case. All you do is put in a new barrel when it's broken in a traffic accident.

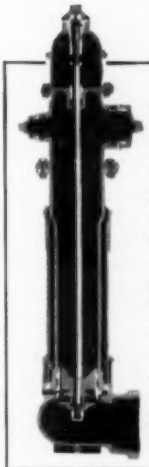
MATHEWS MEANS FIRE PROTECTION

LONG LIFE. Mathews Hydrants are protected at wear points by bronze bushings — corrosion and rust are licked.

TROUBLE-FREE. The stuffing box plate, cast integral with the nozzle section, provides a positively leakproof construction — water, sediment and ice cannot interfere with operating thread.

LOW-COST MAINTENANCE. Only one point requires lubrication — and that only during routine inspections.

REPLACEABILITY. A Mathews leveled in an accident can be replaced without excavating and in a jiffy. Community protection is interrupted only for minutes.



The Mathews includes every quality feature...

Compression type valve to prevent flooding • Head turns 360° simply by loosening bolts • Replaceable head • Nozzle sections easily changed • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • A modern barrel makes an old Mathews good as new • Mechanical-joint pipe connections as needed

MATHEWS HYDRANTS

Made by R. D. Wood Company

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PUBLIC WORKS DIGESTS

THE HIGHWAY AND AIRPORT DIGEST

Oklahoma Test Road

Work is under way on the construction of a test road for the Oklahoma State Highway Commission "to determine the durability, lasting qualities, first costs and surface maintenance costs under heavy truck and auto traffic" of portland cement and asphaltic cement pavements. Four miles of each are being constructed, in parallel 24-ft. pavements, with a 24-ft. grass median, each lane alternating the two kinds of pavement. After the embankments have been rolled to 95% Proctor density, design thickness of sub-base, base and surfacing materials will be determined for each type of pavement, considering recommendations by the Asphalt Institute and the Portland Cement Assn. The maximum gradient is approximately 3% and maximum curvature 2°. An aim of this road is to educate the public and signs will be placed where each type of pavement begins and ends. A citizens' committee of 30 members will sit in and watch progress of the project.

"Oklahoma Test Road to Compare Designs." *Better Roads*, November.

Increasing Use Of Soil-Cement

There is now in the United States more than 100,000,000 sq. yd. of soil cement, unknown 20 yr. ago. Originally used only for shoulders and light-traffic roads, it is now used for city streets, airports, ditch lining; repair and reconstruction of existing roads and other purposes. It has been proved practicable with a variety of soils — both sandy and heavy clay soils and quarry screenings in North Carolina; scarified bituminous surfaces and granular bases on city streets in Peoria, Ill.; sandy clay loams and silty clays in Tennessee. Airports are especially suitable for this type of foundation construction; during the year 1952 it was used for this purpose at Columbus, Neb., Cairo, Ill., Graves County, Ky., Paris, Tenn., Racine, Wis. and Sterling, Colo. California has constructed more than 4.5 million sq. yd. of soil-cement base for concrete pavements to prevent possible faulting at joints and subgrade pumping and to increase subgrade bearing values. The latest methods of construction, employed in laying 40 miles of soil-cement base at Edwards Air Force Base in California, employs train-lane methods to produce about 5,000 sq. yd. per 8-hr. shift. The surface is formed into windrows, on which bulk cement is spread by a spreader closely followed by a mixer which supplies the necessary water; the damp mixture is then spread by a motor grader and rolled, sealed with an asphalt emulsion and covered with 2½ in. of bituminous concrete wearing course.

"Soil Cement Is Versatile." *PUBLIC WORKS*, December.

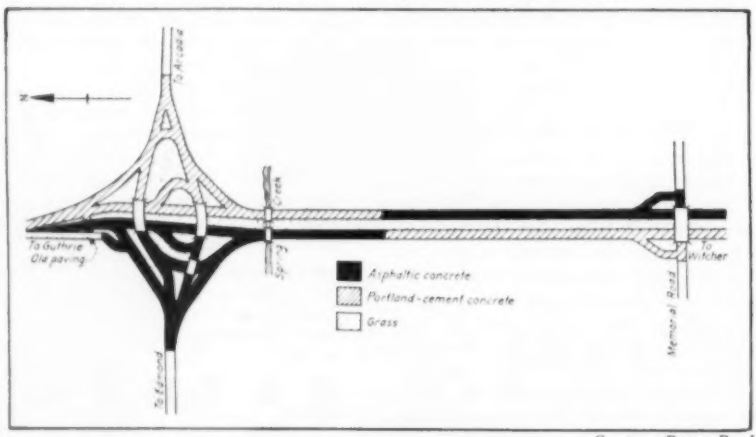
Psychological Causes of Automobile Accidents

An examination of 700 reports of automobile accidents in the Netherlands showed that in 450 cases the accident was due to the psychological condition of the driver at the moment. Dr. H. Y. Groenewegen, who presented and discussed the data before the Netherlands Road Congress, classified the psychological conditions which commonly cause accidents as: 1) A sense of power, manifest in recklessness, lack of consideration and impatience. 2) Lack of confidence—timidity and lack of initiative. 3) A sportive, nonserious attitude towards the risks involved.

"De Menselijke Factor Bij Verkeersongevallen." *Wegen* (Holland), October.

Paving Steep Streets

Duluth's streets vary in grade from level to 27%. They are paved with high-grade asphaltic concrete, the mix and surface finish varying with the grade. As the gradient increases, the proportion of asphalt used is decreased, to diminish or prevent pushing, creeping or washboarding. On high-type bituminous mats they use RC-1 or RC-2 for seal coat, 0.2 gal. per sq. yd. on flat grades with 30 lb. of sand, chips or pea gravel, up to 0.3 gal. and 40 lb.



Courtesy Better Roads

● **LAYOUT of test section of highway near Oklahoma City, Okla.**

"Not one nickel for repairs!"

That's what Harold A. Tice, Street Foreman, Ames, Iowa, reported after the first nine months' use of this Cat* D4 Tractor with No. 4A Bulldozer. And that's not all. "We asked the city for this machine," he continued, "and now that we have it, we use it on practically every job. It has become one of the mainstays of our equipment family. I don't know how we'd get along without it."

Performance *on the job* is the only way to make a true appraisal of a machine's worth. Performance on hundreds of jobs shows that the D4 Tractor with matching Bulldozer does *more* work at *lower* cost with less *down* time than any competitive unit its size. Why? There are lots of reasons. For example, its power, weight, traction and blade are *balanced* for maximum work capacity. Visibility is good and controls are responsive—other assets in big production. Blade and tracks are constructed to take tough going and take it longer than any competitive make. These and other advantages add up to performance that gets the nod both from officials and operators.

There's always a spot in any street fleet for such a versatile, money-saving unit. Ask your Caterpillar Dealer to show you how it can help you get more distance out of tax dollars. He's a source of reliable information and prompt service. Want him to demonstrate? He'll be glad to—just name the date and the job!

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of pea gravel on steep grades. Pavements are rolled extensively with 10 or 12-ton 3-wheel rollers.

"High-Type Asphaltic Concrete in Duluth." By Arthur W. Tews, City Engineer. *Roads and Streets*, November.

Reinforcing Asphalt Pavement

The use of wire fabric for reinforcing asphaltic concrete pavements is being tested in Washington D. C. to determine its effectiveness in preventing pavement rippling and piling up and in controlling formation of cracks. A total of 3,000 sq. yd. was laid in sections alternating with unreinforced sections. These were laid on existing concrete pavement which contained cracks, which cracks were located and photographed before the asphalt was laid. The fabric was laid directly on the concrete, in sheets 11½ ft. wide by 7 ft. long which overlapped 6 in. transversely and were wired together. On this a binder course was laid, followed by a wearing course. Similar tests were made in 1946 in Texas, and later in Minnesota, Illinois and Indiana. It is hoped that this construction will be especially useful at bus-stopping stations, where pavements are susceptible to rippling and piling up, as well as prevent cracks in the asphalt above cracks in the concrete base.

"Steel Reinforces Asphaltic Concrete." *PUBLIC WORKS*, December.

Should Counties Produce Surfacing Material?

Replying to a questionnaire asking their opinions, a number of highway officials expressed decided opinions on the subject. The primary advantage claimed is economy. If the department owns portable equipment, it can be moved to pits close to a project, thus reducing hauling costs. On the other hand, where commercial plants are supplying surfacing material at reasonable cost, engineers can see no advantages in producing their own aggregates. Some officials feel strongly that it is unwise for a public agency to compete with private business. A department planning to buy crushing equipment should study sources of raw material, and the quality and quantity of aggregates that will be needed during a year, before going ahead.

"Buy or Produce Surfacing Material." *Better Roads*, November.

Effects of Jet Aircraft on Pavements

Inspection of airfields in England from which jet aircraft have been operating indicates that bituminous surfaces are damaged by them in various degrees; also joints in concrete pavements. Tests were conducted to learn the effects on concrete of extreme conditions, such as inclination of jet of more than 10° and temperature of exhaust gas of 350°C on striking the pavement. To determine temperatures at the surface, thermetric paints were applied to it. Also temperature measurements at the surface and at various depths were made with thermocouples. These tests indicated that thermal stresses caused full-depth cracking. Surface crazing occurred, probably caused by the rapid drying when exposed to the jet stream. Surface spalling appeared to happen to high-grade concrete only when the surface had been subjected to high temperature.

Efforts to prevent damage to bituminous surfaces included covering them with various protective carpets. Asbestos cement carpet was broken up and dispersed because of little adhesion to the asphalt. A 1-in. carpet of ½-in. to 1 in. impregnated

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wooden chips mixed with cement map-cracked to a depth of ¼ to ½ in. and there was considerable drying shrinkage. Polyvinyl chloride sheeting was lifted at the joints by the blast. The solution of the problem probably requires the development of entirely new materials.

"Effects of Jet Aircraft on Airfield Pavements." *The Surveyor* (England), November 7.

Traffic Safety In Evanston, Ill.

Evanston has been named the safest city in the country, with much of the credit going to the traffic engineering department. With a population of about 75,000 it has less than 50 stop signs, but these are carefully located. A stop sign is placed only where there is a serious obstruction to sight between intersecting streets. If shrubbery presents such an obstruction, the owner is required to remedy it. Also stop signs are used only where there have been at least 3 angle-type collisions during the previous 12 months; and only where the traffic passing through the intersection totals at least 250 vehicles an hour during a 6-hr. period. When the traffic reaches 1,000 vehicles an hour for 6 hours, traffic lights are recommended. On a large map of the city the location of each accident during the previous 12 months is indicated by a pin. When 3 pins appear at any one location a study is made of the accident reports and of the location to learn the cause. At one location 30 accidents had occurred, all in the afternoon and involving east-bound traffic; the cause was found to be reflection of the sun from the lenses of the traffic signal, which made it impossible for drivers to tell the color of the traffic light. This was remedied by installing non-glare lenses and more powerful lamps.

"Evanston's Engineered Traffic Safety." By Phil Hirsch. *PUBLIC WORKS*, December.

Marl-Asphalt Street Pavements

Fort Pierce, Fla., paves its streets with marl, a rock peculiar to that state which can be handled with a power grader and compacts into a hard base that resembles concrete. About 8 in. of this is spread on the subgrade, treated with cutback asphalt, 3 gal. per sq. yd., mixed with a power grader, and compacted to 5 or 6 in. depth with a rubber-tired roller. This is seal-coated and blotted with a thin coat of sand or fine slag. The pit from which the marl has been obtained is used for sanitary fill; the overburden, which had been stockpiled alongside, being used for cover material. The cost is about $2.00 per running foot for a 20-ft. street.

"Mixed-in-Place Marl Asphalt." By H. F. Stanton, City Manager. *American City*, November.

The West Virginia Turnpike Construction

This 88-mile road is being graded under 21 contracts by what is said to represent the most costly concentration of grading machinery in the history of road building. It includes more than 2,000 machines, of which 61 are 2½-yd. to 5½-yd. shovels; 291 wagons, 264 tractors, 101 scrapers, 39 graders, 190 drills, 122 compressors. The material excavated was "unclassified" and included rock of all kinds, from extremely hard sandstone to soft shale, and soil from clay to gravel, totaling about 30,000,000 yards. The contractors have delivered over 1,000,000 cu. yd. weekly. About a third of the wagons are 22-ton dump. Of the compressors, the 600's are in the

raise manholes this cost-saving way

fast, economical, safe

On your next resurfacing project you can do a permanent, secure job of raising manholes in a fraction of the time required by old methods if you use W-B Manhole Adapters.

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1. **ECONOMY** – The "Manhole Adapter" is much less expensive to install than adjusting the manhole ring.
2. **SAFETY**—The "Manhole Adapter" is installed just prior to application of finish coat. No lights, no barricades needed.
3. Structural strength of street is not impaired.
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5. The finish job presents a smooth, level appearance. In rolling for compaction, the "Manhole Adapter" and cover conform to street contour.

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Send for our new brochure today. Or better yet mail blueprint of your standard manhole ring and cover and we will quote prices promptly without obligation.

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majority, many of them the new turbine type models. Aluminum air pipe is used on two contract sections, 4-in. pipe weighing ¾ lb. per foot. Ten to 15 million pounds of explosive will have been used, removing 1¼ million yards of rock in cuts 30 to 147 ft. deep.

"30,000,000-Yard Turnpike Job." By Harold J. McKeever, Editor *Roads and Streets*, November.

• • •

Jack Ritter

(*Continued from page* 14)

weeks summer course at Camp Davis, the U. of M.'s summer camp in the Jackson Hole country of Wyoming. A portion of the expense incurred by each student was borne by the MRBA. Upon completion of the course the majority of trainees were employed by the Highway Department as Engineering Aides. After one year of experience, supporters of the program feel that it achieved a dual purpose, providing badly needed employees for the Highway Department and stimulating interest in civil engineering among high school students.

We also like Kansas' plan, announced some time ago, by which six English-speaking Mexican engineers and one British engineer are to be employed by the Highway Commission for a period ranging from one to three years. This scheme was devised to help alleviate the shortage of qualified civil engineers in that state. Obviously, benefits to all parties should result from its operation.

Installation of Culverts — Although this is the season of minimum construction activity in many sections of the country, a good article on construction can never be overlooked. Such an article is one entitled "How to Install Culverts for Lasting Service", which appeared in the November issue of the Highway Magazine, the colorful publication of Armco Metal and Drainage Products, Inc., Middletown, Ohio. Written by an old acquaintance of ours, W. T. Adams, the article places stress upon the fundamentals of good installation; principles which if properly applied will lead to long life and low maintenance costs. In brief statement, "Drainage structures need to be well located, properly bedded, properly assembled and carefully backfilled." Mr. Adams points out that many agencies have adequate specifications covering culvert installation but that careful supervision and inspection are absolutely necessary if adequate results are to be achieved in this field of work.

Around the Country—F. V. DuPont, Commissioner of Public Roads, has expressed an opinion that a change in the federal aid program to provide a 75-25 matching basis on roads which are part of the interstate system would greatly accelerate improvement of this vital mileage. A 30-mile per hour speed limit has been placed in force on the George Washington Bridge during peak traffic hours in an effort to reduce the number and severity of accidents occurring on the span; the number of accidents increased sharply in 1953. Welded wire fabric was used recently as reinforcement for a hot asphaltic paving mixture used to resurface an existing concrete runway at the Indianapolis Municipal Airport. The White House Conference on Traffic Safety will be held on February 17-19. Plans for construction of a four-mile dual test road near Okie City have been announced by the Oklahoma Highway Commission; purpose is to compare portland cement and asphaltic concrete pavements under identical

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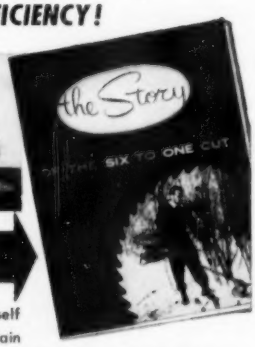

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conditions. An improvement project on U. S. 90 in Louisiana, adjacent to the Huey P. Long Bridge at New Orleans, involved the construction of a base composed of shell dredged from Lake Pontchartrain; on a portion of the project the base is 21 inches thick.

A Positive Viewpoint — We thoroughly enjoyed the editorial which featured the October 1953 issue of the Asphalt Institute Quarterly (801 Second Avenue, New York). Gist of the editorial is that, although the need for highway improvement in this country is very real, much has been done and is being done to provide a highway transportation system which will meet the demands of modern traffic. Conclusions reached are, prophets of doom to the contrary, that "(1) useful highway expenditures are much larger than generally supposed; (2) most highways are being steadily improved, although a faster rate is desirable; and (3) direction of expenditure in accordance with need is the real requisite today." We heartily agree. This is the time when we must take a hard-headed, realistic look at what our real needs are, how these needs can best be met, and how to provide for a planned program of orderly highway improvement.

Predictions for '54 — This is the time of year for the annual prediction derby, so here we go; hand us the limb-cutting saw, please sir. In spite of the continuing drive for increased federal aid for highways, the 1954 Federal Aid Act will not provide more than 650 million dollars per year for this purpose. Highway building, along with most other forms of construction, will decrease slightly in dollar volume during 1954. There will be continuing toll road activity in many areas, but actual starts of new toll road projects will be few in number and confined to high population, high traffic density states; starts may be made more difficult in some cases because of increasing reluctance of investment groups to bid for turnpike bonds Look for the increasing use of the red "stop" sign, and other signs of distinctive colors, in all sections of the country. Traffic safety campaigns will continue at a high rate, since such efforts in 1953 have enjoyed very considerable successes in local areas in reducing the toll of highway accidents. Whatever may come in 1954 we sincerely hope that you, personally, will enjoy the best year you have ever had; best wishes to each of you.

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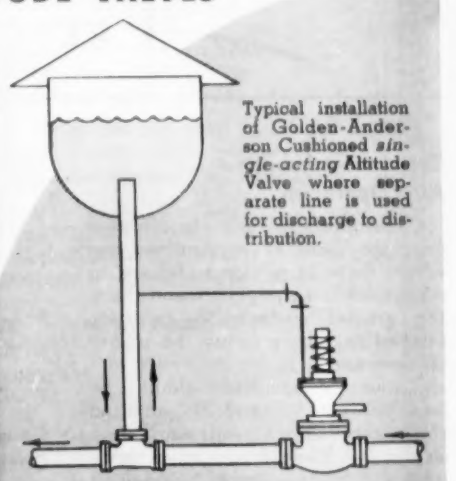
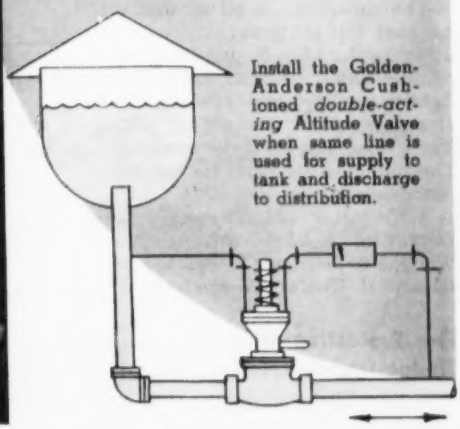
Assure Accurate Water Level Control

Under any Climatic Conditions!



Typical installation of Golden-Anderson Cushioned *single-acting* Altitude Valve where separate line is used for discharge to distribution.



Install the Golden-Anderson Cushioned *double-acting* Altitude Valve when same line is used for supply to tank and discharge to distribution.

Golden-Anderson Altitude Control Valves require no floats or complicated fixtures, can be quickly and easily installed, either above or below ground, and maintain water levels in reservoirs and tanks within 3" to 12" variation.

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Chlorinators should be located near the point of application, and where there is minimum hazard to employees and equipment; and above the ground surface, to facilitate ventilation. There should be plenty of room and light for inspection and operation. Temperature should be kept between 65° and 70°, and the room kept dry. Checks for leaks should be made frequently. Spare parts and gaskets should be on hand for immediate use when necessary. For cleaning, carbon tetrachloride is recommended; wood alcohol can be used, but not grain or denatured alcohol. If grease is used for protecting external parts, rub it on lightly and remove often with a clean rag. For protecting plated parts, clear lacquer is recommended. The author gives rules for handling containers.

"Chlorinator Maintenance and Operation." By J. P. Kavanaugh, of Wallace & Tiernan Co. *Sewage and Industrial Wastes,* November.

Fire Protection at Sludge-Drying Plant

In the sludge-drying plant operated by Baltimore since 1951, there is possibility of the sludge catching fire either while being dried by air at 1,000° F or by spontaneous combustion in the storage bins. To extinguish fire in either place, carbon dioxide is used. Twenty-eight 75-pound cylinders are provided for bin fires and seven for primary charge for fires in the production equipment. They are controlled by electric switches or manually. If a blaze occurs in the equipment, carbon dioxide is discharged into the ducts and operating machinery. To control fires in bins, thermocouples tied to an indicator panel and located at different places in the bins indicate a rise of temperature at any point. The carbon dioxide can then be discharged at any of four levels in any bin. Or the material can be drawn from the hot bin to another bin, and when the hot material reaches the outlet of the former it is dumped on the ground.

"Fire Protection for a Sludge-Drying Plant." By Walter E. Morgan, Walter Kidde & Co. *PUBLIC WORKS,* December.

Construction and Operation of Oxidation Ponds

Oxidation ponds, as distinguished from lagoons, are ponds of regular and controlled shape, depth and marginal area, specifically designed and constructed as a waste treatment device. They are used to treat the effluents from primary treatment, or from complete treatment temporarily when shock loads reduce efficiency. They are used as the only treatment at rural schools, tourist courts, and small industries, and instead of drainage fields to receive effluents from septic tanks. They are sometimes preceded by an anaerobic pond, but such ponds may cause nuisances. The great quantities of algae produced as much as 600 lb. dry weight per day from 25,000 population) are valuable as fer-

"Beachcomber" Solves Beach Cleaning Problem

CLEANING up the beaches at seaside resorts has always been a problem. All sorts of refuse and junk are dropped or left in the sand —broken glass, wire, bottle caps, paper, sun glasses, etc. The "Beachcomber" has been developed by Barber-Greene Co. to solve this problem. It is made up of a crawler-mounted elevator which discharges onto a vibrating screen of ½-in. mesh. It digs to a depth of 4 to 10 ins., 8 ft. wide. It will handle 100 to 130 cu. yds. of sand an hour. Atlantic City, N. J., has been testing one of these machines.

● BEACHCOMBER works over the beaches at Atlantic City, New Jersey.

tilizer or cattle food. Texas experience indicates 50 lb. of BOD per acre as recommended loading (which can be increased to 250 lb. for a limited period); depth of 2.5 to 3.0 ft.; the provision of multiple inlets or recirculation to provide rapid and thorough mixing, or a number of parallel ponds. The ponds should be practically impervious to prevent loss by seepage. The maintenance required is simple but should not be neglected. Marginal growth of any vegetation but grass should be prevented. Any leaks in the dike or piping should be located and repaired quickly, and stoppages in the outlet removed.

The above is from a paper before the American Public Health Ass'n by D. F. Smallhorst, B. N. Walton, Jr. and Jack Meyers, of the Texas Dept. of Health and Univ. of Texas.

"Oxidation Ponds in Sewage Treatment." *PUBLIC WORKS*, December.

Joints for Sewer Pipe

The effectiveness of a sewer using the most nearly perfect pipe is dependent on the quality of its joints. A completely fool-proof joint has yet to be perfected, but the author describes a number of materials which have proved more or less satisfactory. These include hot-poured filled asphalt; filled plasticized sulfur compositions; filled coal tar pitch; hot-poured filled plastic; preformed asphaltic; neat cement in a metal collar; trowelable compositions, ready-mixed or mixed on the job; chemical-resistant materials; tubular joints; vinyl plastisol. For carrying domestic sewage, he recommends, where root-resistance is not important, vitrified clay pipe jointed with hot-poured filled asphalt; and, where root resistance is essential, a hot-poured filled plastic. Where solvents or warm industrial wastes are to be carried, a combination joint consisting of an infusible furane and a plasticized sulfur cement is recommended.

"Modern Materials and Methods for Joining Sewer Pipe." By Raymond B. Seymour, Atlas Mineral Products Co. *Sewage and Industrial Wastes*, November.

Agricultural Values of Sewage

Sewage as applied to land has a four-fold value, for it contains the major fertilizing elements and micro-nutrients, organic matter and water. European experience of half a century with sewage farming has

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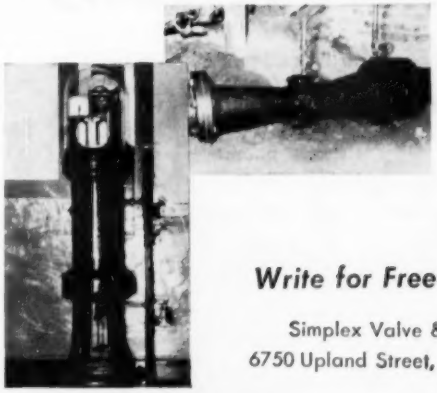

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demonstrated that sanitary sewage and many industrial wastes can be used successfully for agricultural, industrial and other purposes. Experience in this country has shown that water recovered from sewage through land disposal can be used in water-shortage areas, but where reclamation is the only aim the venture is usually unsound economically. Therefore, the emphasis should be placed on conservation of the agricultural values in sewage.

"Agricultural Values of Sewage." By Bernard P. Skulte. *Sewage and Industrial Wastes*, November.

Cultures and Enzymes As Aids to Digestion

The authors conducted experiments to learn the effects of "Enzymatic" and "Bionetic" on digestion of sewage, which might be used as initial cultures to shorten the "working in" period required to establish indigestion; or might be added to a tank to accelerate digestion which has already been established. Theoretically, all the bacteria necessary for digestion are present in the raw solids. Though few in number, they multiply and establish themselves under favorable environmental conditions. Under such conditions, the rapid rate of multiplication of the bacteria normally present could establish the necessary flora without the aid of artificial cultures; and if conditions are not favorable, the benefit will be negligible. Furthermore, it is unlikely that the diverse bacteria necessary for digestion are included in the artificial culture. The tests made by the authors did not show any evidence of improvement due to the addition of any enzymes or bacterial cultures to either sterile or nonsterile fresh solids and to sewage; with the single exception that higher BOD values were indicated in supernatant liquor when pure and strong enzyme preparations were added to *sterile* fresh solids.

"Value of Culture and Enzyme Additions in Promoting Digestion." By H. Heukelekian and M. Berger, of N. J. Agricultural Exp. Sta. *Sewage and Industrial Wastes*, November.

Sewage Plant Trains Foreign Engineers

The sewage plant of Chapel Hill, N. C. was built and is operated jointly by both the town and the University. The latter furnishes the laboratory control and uses the plant for field training of the students, which include graduate engineers from many countries of South America and Europe, who are given an intensive 8-week course. In 1953 there were present engineers from Germany, Japan, Mexico and five South American countries.

"Sewage Treatment 'Town and Gown' Partnership." By J. L. Morrison, School of Journalism, UNC. *PUBLIC WORKS*, December.

Other Articles

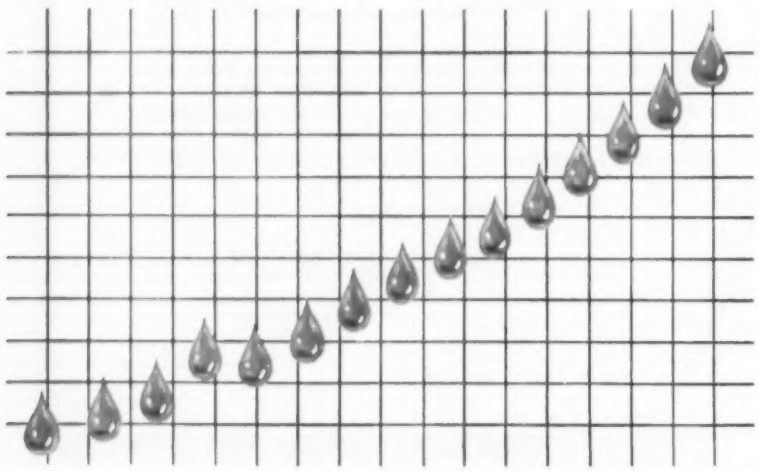
Effect of biocatalysts on activated sludge. Experiments with "Bionetic" and "Enzymatic". "Biocatalysts and Waste Disposal," by Ross E. McKinney and Leon Poliakoff, S. W. Found. for Research and Education. Sewage and Industrial Wastes, November.

Sterilizing sewage by ionizing radiations is possible. "Treatment of Water and Sewage by Ionizing Radiations." By Cecil G. Dunn, Mass. Inst. of Technology. Sewage and Industrial Wastes, November.

"Floatibility of Oil and Grease in Waste Waters." By Richard Pomeroy. Sewage and Industrial Wastes, November.

"Soluble Oil Wastes Treatment by Pressure Flotation." By Austin H. Beebe, Chrysler Corp. Sewage and Industrial Wastes, November.

Treating metal industry wastes by a



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flowing through system. "Flow-Through Treatment of Metal Industrial Wastes." By Frank J. Hendel and V. T. Stewart, Wighton-Abbott Corp. Sewage and Industrial Wastes, November.

"Ocean Outfall Studies at San Diego." By Frank J. Kersnan and David H. Caldwell. Sewage and Industrial Wastes, November.

Designing relief sewers. Experiences of a consulting engineer. "Relief Sewers: How to Build Them so the Public Likes Them." By Geo. O. Consoer. American City, November.

Metals salvaged from refuse are expected to average 2,000 tons a year at Sheffield, England. "Economical Refuse Disposal at Sheffield." The Surveyor, Nov. 7; Municipal Engineering, Nov. 6; Contractors Record, Nov. 11.

Two crews for each refuse collection truck at Greenbelt, Md., and other practices. "New Ideas in Refuse Sanitation." American City, November.

Garbage service fees in Gainesville, Fla. are placed on the bills for the city-owned light and water. "Disposal by Sanitary Fill Costs." By C. E. Wright, PUBLIC WORKS, December.

• • •

Surfaced Roads Raise Farm Values By 52 Percent

Farm and other rural property values are increased by 52 percent when roads serving the property are improved from dirt to hard surfacing, according to a study recently made at Cornell University.

The study, an unpublished thesis entitled, "Analysis of Highways in Rural Areas of New York" by W. M. Allred, further shows that when dirt roads are improved by gravel surfaces, property values rise by an estimated 18 percent.

In 1927, the first study of this type was conducted. Published in the Agricultural Experiment Station Bulletin 479, Cornell University, 1929, it showed that farmers estimated the value of their real property would be increased approximately 25 percent if they were located on hard roads instead of dirt or gravel ones.

A similar study in 1935, and reported in the Agricultural Experiment Bulletin 616, Cornell University, 1936, showed values to be 22 percent more on a gravel road than a dirt road and 48 percent higher if on a hard surfaced road rather than dirt.

The influence of distance on property values also was determined in the most recent study. Owners living on gravel roads less than 1 mile from a hard road estimated a hard road to add 15 percent to this property value. This was identical to the 1936 results.

Property owners living between one and two miles from a hard surfaced road estimated a 44 percent increase in value if a hard surface was provided rather than gravel. The figure for 1936 was 20%.

While the study draws no conclusions as to the reasons for the constantly increasing value of improved roads to farmers and other rural residents, it is obvious that such values are created through the increasing dependence of the rural population on the motor vehicles. Practically everything farmers sell or buy is moved by highway. Their children, almost 7½ million of them, go to school by bus. Their fuel is brought by truck. Their friends visit by automobile. In every phase of rural life, the highway is the medium of accomplishment.

That improved rural roads add to the value of rural property is but one of the benefits of adequate roads. Lower operating cost of the vehicles is another. It all adds up to the fact that the benefits received from an adequate road system are enormous and is but another substantiation of the claim that no matter where they are—adequate roads don't cost, they pay.—From "Highway Highlights."

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Observation on the Resting Habits of Flies

Diurnal and nocturnal observations of fly resting habits in urban areas were made in the vicinity of Pharr, Tex., from January 1950 to June 1951 and in Savannah, Ga., during a short period in the summer of 1950. In both areas, ground surfaces and scattered garbage were the principal daytime resting surfaces for all observed species except *Drosophila*. Likewise, grasses, weeds, trees, and shrubs represented the most important nocturnal resting surfaces for all species except *Drosophila*.

Based on these studies, residual spray operations for urban fly control should include the treatment of grasses, weeds, shrubs, the lower limbs of trees, the interior of privies, and garbage cans and their immediate environs. The spraying of outbuildings or the outside of any structures was not indicated.

The high concentration of flies in preferred resting places at night suggests that selective space spraying of these resting places at night might give more efficient fly control than present daytime space spraying procedures.

The Georgia studies in 1950-51 indicated that residual spray applications for fly control on rural premises should include the treatment of porches; the lower portions of trees and shrubs adjacent to houses and animal shelters; barn interiors; and the ceilings and upper portions of the walls of unscreened dwellings. The high concentration of flies at night in relatively small areas suggest the possibility of controlling flies economically by the selective application of space sprays at night. (Am. J. Trop. Med., Nov. 1952, Maier, Baker, Bogue, Kilpatrick, and Quarterman)

• • •

Design Details of Oklahoma's Turner Turnpike

THE Turnpike between Oklahoma's two largest cities, Tulsa and Oklahoma City, is claimed to be the most modern highway in the United States. It is 88 miles in length and will save 14 miles in distance between the two cities. Estimated saving in driving time is one hour. In addition to the Turnpike proper, the cities of Tulsa and Oklahoma City have constructed four-lane divided by-passes. These, with the Turnpike proper, will provide 102 miles of continuous four-lane, divided, limited access paving. Estimated safe driving time for the 102 miles is one hour and 45 minutes. The through fare for passenger cars will be $1.40 with other traffic scaled up from that.

There are no grades of more than three per cent. There are no curves West of Sapulpa of more than 3-minute curvature. There is one 1° 30′ curve at the East edge of Sapulpa and one 1° 00′ curve near the Tulsa Terminus. Both of these curves are designed for a 70-mile per hour speed with ample safety factor.

The paving will consist of two 24-foot lanes of asphaltic concrete, separated by a 15-foot grassed median, each with a 12-foot paved shoulder. These are 6-inch asphalt stabilized base and bituminous surface. The asphaltic concrete paving of the Turnpike is designed for 28,800-pound axle loads, as compared to the 18,000 pound maximum axle load design used on State Highways. The shoulder paving is underlaid by 12-inches or more of

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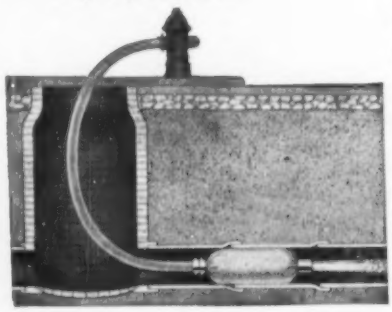

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select subgrade material. The paved shoulders are not intended as driving lanes but are for the purpose of servicing disabled vehicles.

Guard rail will be placed 10 feet from the edge of the pavement on all fills over 10 feet high. Reflectorized delineators will be placed in the median and on both shoulders at intervals of from 100 to 200 feet throughout the length of the Turnpike. A dashed, reflectorized center stripe will separate the two driving lanes. Traffic signs will be large, reflectorized, white, scotchlite letters on a reflectorized green background.

The Turnpike is served by the most up-to-date restaurant and service station facilities. At the midpoint are the Mid-Way Restaurant and service stations, with glass-enclosed pedestrian overpass. Four other service stations are provided.

Motorist protection will be provided by the State Highway Patrol. The Authority has previously approved a minimum speed of 40 miles per hour but has not at this time set a different maximum speed than the state speed limit of 65 miles per hour. The Highway Patrol, the Turnpike Maintenance Offices and Toll Booths, are direct line interconnected with a combined radio and telephone system for quick handling of emergency situations.

• • •

Street Cleaning

(*Continued from page* 63)

We have a population of about 327,000 in Birmingham, with an area increase of about 30 percent through annexation which has largely come during the last four years. With this increase has come an expansion of street development and construction, together with street cleaning problems incidental to them. Our motor vehicle population has been increased about 100% since 1946—and with this has come increased "on-street" parking and the problems arising from traffic congestion.

These factors all produce a condition which results in the necessity of doing more work in a much shorter period of time on any given portion of a street. To accomplish this, three general factors have helped make it possible to meet the problem. They are: the increased use of more and different types of labor-saving equipment; regulations of street use through parking restrictions; and public cooperation in reducing street litter.

In the equipment field, street sweepers are now made with greater hopper capacities—2 to 3 cubic yards being usual. This increases street lengths swept between dumpings, and resu ts in fewer stops for pick-up crews. Some cities are using detergents in their street flushing and washing activities. Front end loaders are a great help in picking up the street accumulations, reducing costs considerably over hand loading.

Considerable advancement has been made during the leaf season. Cleaning activities reach the proportion of a three-ring circus, or a small boy's dream. Traveling through various communities one may see many different techniques and types of equipment being used, all with the purpose in mind to do more in less time. Street flushers, motor graders, leaf pushers (mounted on trucks, tractors, and sweepers) are used to windrow or pile up the leaves. Loading is effected by means of vacuum packers, and shovels, and even snowloading equipment (both blower and conveyor types.)

The efficient use of motorized equipment for street cleaning requires that the streets be made available at certain times for clean-

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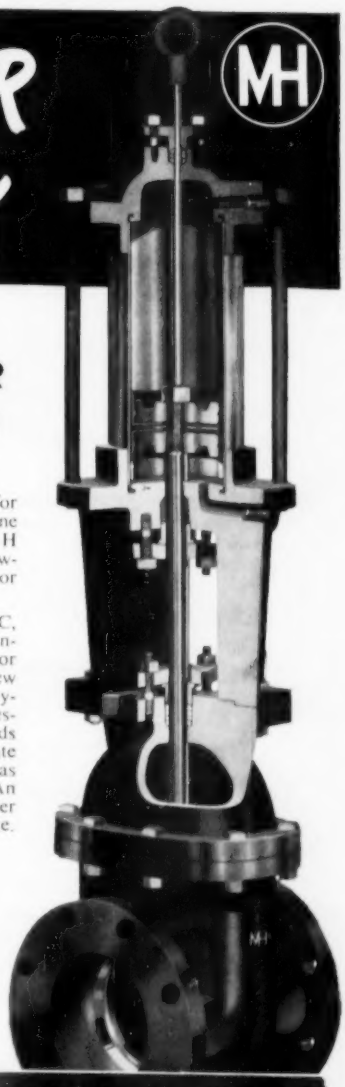

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ing, and regulations must be made to provide this required time. Without these regulations, it is impossible to use this equipment to its full capability and we would of necessity have to resort to hand cleaning methods.

The business district of Birmingham is an area of about three square miles. Hourly parking restrictions or early morning "no parking" restrictions help somewhat, but have not been sufficient to permit proper cleaning.

Public cooperation is a much desired factor in the cleanliness of a city. It can be obtained only through constant and continued effort. This effort may be expressed through clean-up campaigns, poster displays, news stories, radio talks, movie skits, and other educational methods. To be of lasting effect, however, we have found that clean-up drives must be repeated often and regularly.

It seems, therefore, if we are to have clean, healthy cities, it will be necessary to depend on the use of new and improved equipment, coupled with parking restrictions to permit its use, and public cooperation to reduce the accumulation of street litter. The high cost of labor and the increased work load necessitate more and more mechanical equipment, and we must provide the opportunity for the equipment to work effectively.

• • •

Fairbanks Water

(*Continued from page* 66)

would produce the necessary velocity in the service connection. William B. Page, of the Arctic Health Research Center of the Public Health Service, conducted extensive scale model tests of various types of inserts which verified the theoretical work which had been conducted and established the feasibility of such a system. After careful study of this test data, we determined that the only practical way to select and design the type of insert which would be most satisfactory was to conduct full scale tests of numerous types of inserts. This work was carried out in the hydraulics laboratories at Washington State College using a 4-inch wood stave pipe main and a 40-foot ¾-inch copper service pipe. Numerous types of inserts, or pitorifice as we have named them, were tested and the most satisfactory type was selected. The same pitorifice is used for both the upstream and downstream lines with excellent results.

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The heat loss from the service pipes at the velocities which can be maintained and at the ground temperatures which will be encountered was a problem which was given careful study and investigation. In order to maintain a minimum temperature differential in the service connection the two pipes will be laid, and in fact, tied together and by so doing there will be a definite heat flow between the two pipes. However, under this condition it is very difficult to make an accurate theoretical analysis of the heat loss. Therefore, as a means of checking our theoretical work we set up a full scale model of the service connection in a refrigerated room at the Washington State College laboratories. This model was composed of a 40-foot length of copper pipe buried in sand, a small pump and a bucket reservoir. Thermocouples were installed in the influent and effluent lines to measure the temperature of the water entering and leaving the pipe; and in addition, ten thermocouples were placed in the sand around the pipes and at variable distances from the pipes. In this way we were able to record the water and sand temperatures and plot the heat transfers under varying conditions of room temperature and water velocity. With this data we made the necessary assumptions to carry out the theoretical calculations of the heat losses in the service connections.

By estimating the number and length of service connections which will be installed in the system, it is a simple matter to determine the total heat loss in the service connections. This combined with the heat loss from the mains represents the total amount of heat which must be supplied to the system. This heat will be supplied from three sources; namely, the pumps, the specific heat of the make-up water which will enter the system at a temperature above that of the water in the system, and from a heat exchanger using condenser cooling water from the steam plant which would normally be wasted directly to the river.

These, in brief, were the steps followed in designing this system. We believe that a water distribution system has been developed which can be installed and operated at a minimum cost to the people of Fairbanks and will enable the people in other Arctic Regions to be supplied water the same as other areas in less difficult climate zones.

PUBLIC WORKS

EQUIPMENT NEWS

Published Monthly January, 1954

Austin-Western Announces New Hydraulic Crane With Telescoping Boom

AURORA, ILL.—A new hydraulic crane, built by Austin-Western Company, combines the features of crawler, truck and erection cranes with those of industrial shop cranes. It can lift and transport its maximum load any distance indoors or outdoors; with boom extended, hook can be raised 24 feet or lowered 30 feet below ground level. The telescopic boom can be raised to any point between the horizontal and 45 degrees, and can be turned continuously through 360 degrees. An exceptional efficiency rating is obtained through use of a standard 6-in. center distance 50:1 Cone-Drive gearset in the boom lifting mechanism, which is driven by a 750 rpm Vickers hydraulic motor. A second Cone-Drive gearset, with a 5-in. center distance and 40:1 ratio, is used on the crane swing drive to provide smooth operation and save both space and costs. Rated capacity of the crane is 3200 lbs. at a boom radius of 18 feet, and 8,000 lbs. at a 10-foot boom radius.

Hydraulic crane with 4-ton lift will help in storage yard on the job

Six New Tractor Shovels Added to Materials-Handling Equipment Line

BUCHANAN, MICH. — Clark Equipment Co. has announced six separate models of a tractor shovel or front-end loader which will be marketed under the name of "Michigan Tractor Shovel." Said George Spatta, Clark president: "The addition of tractor shovels to our line of materials-handling equipment is a significant step forward. We are now able to supply an item of equipment for use where material is handled in bulk." The six models will have capacities ranging from 15 cu. ft. capacity to 2¼ cu. yds. Three major types are in production: A two-wheel drive with bucket wheel drive and rear wheel steering; a two-wheel drive with rear drive wheels and bucket wheel steering; and a four-wheel drive with rear wheel steering. Transmission will be torque converter. Clark Equipment Co., Buchanan, Mich. Circle No. 1-2.

Four-wheel drive and rear-wheel steer are features of this tractor shovel

Magnetic road sweeping is provided by the new Magnetic Road Sweeper which is now available by the Homer Manufacturing Co., Inc., Dept. 252, Lima, Ohio. This equipment picks up nails, wire and ferrous metal pieces from roads, loading areas, airport aprons, runways, etc. It requires no electric power source; and there is no danger of fire or explosion in locations where inflammable or explosive products are present. Made in four sizes, 48, 60, 72 and 96 inches.

Mix-Elvator Handles and Proportions Materials For Concrete Gunning

KANSAS CITY, Mo.—A combination proportioning, mixing and elevating machine, called the Mix-Elvator, is announced by Air Placement Equipment Co., 1013 West 24th St., Kansas City 8. The machine, which is a portable, self-contained unit, ready to operate, has an adjustable ratio control that permits an accurate mixing range from 1:3 to 1:8. Engine speed can be adjusted to give from 2½ to 8 cu. yds. an hour. A complete screening arrangement and single clutch control permit material or aggregate to be handled only once during the complete operation which can be done by one laborer when the stockpile is convenient. More information by circling No. 1-3.

Materials are proportioned, mixed and fed by the compact Mix-Elvator

Concrete Mixer Increases Yardage Output

COLUMBUS, O.—The remarkably fast discharge of stiff concrete, shown in photo on page 136, results from the use of larger bucket and flight blades in the mixer drum.

Use the coupon on page 28 for more information

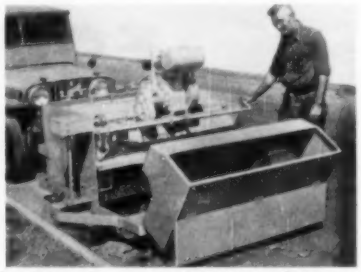
Rapid discharge of stiff concrete steps up the output of the new Jaeger mixer

It is one of two operations in which mixer users have an opportunity to shorten their batch cycle and increase their resultant yardage. The other operation is in charging the batch, for which an automatic "skip shaker" is provided to shake dry material loose from the bucket and throw it more quickly into the drum. Available in 6, 11 and 16 cu. ft. models. Write The Jaeger Machine Co., 552 West Spring St., Columbus 16, Ohio. Circle No. 1-4.

The New "Yard Bird" Power Sweeper Can Be Pushed By Anything That Moves

PEORIA, ILL.—A new power sweeper of unique design has just been announced by Little Giant Products. Called the "Yard Bird," the sweeper can be pushed by anything that moves—fork lift truck, motor truck, industrial tractor, farm tractor or Jeep. Special clamps are available for attaching or detaching in as little as 3 minutes. No tools are required. The broom, powered by a Wisconsin air-cooled engine, sweeps a path four feet wide. There is a 9-cubic foot collection hopper and a 25-gallon sprinkler system to control dust. A 20-in. gutter broom is optional equipment.

Mounted on three large rubber-tired swivel casters, this sweeper is applicable for use in industrial plants, warehouses, garages, streets,

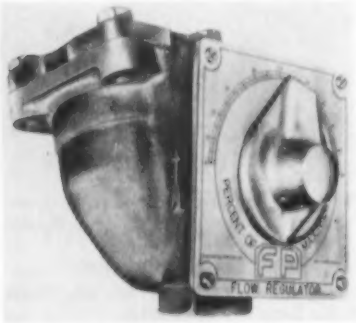


Power sweeper can be attached to any mobile unit for quick clean-up work

airports, cemeteries, parks, playgrounds, college campuses, public utility installations, docks, foundries, railroad shipping areas and similar locations where power sweeping is required and idle time is available on lift trucks or other mobile equipment. Circle No. 1-6.

Self-Operated Regulator Controls Flow within 3 Percent

HATBORO, PA.—An automatic flow regulator, announced by Fischer & Porter Co., which can be screwed directly into a pipe line, maintains a pre-set flow rate despite changes in upstream or downstream pressure. It requires no outside source of energy, nor pneumatic or electric control equipment,



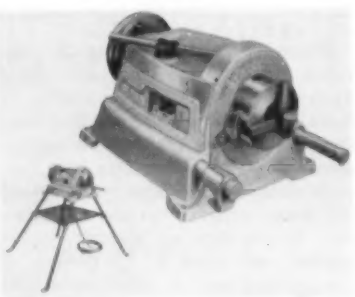
Flow control unit is completely self contained; available in ½ to 2-in sizes

for it is operated entirely by the liquid passing through it. It can be mounted in any position. Made in ½-inch to 2-in. sizes, it will handle flow ranges of 0.5 to 80 gpm, depending on size, with reproducibility of plus or minus 3 percent over a pressure-drop range of 5 to 125 psi. Fischer & Porter Co., Hatboro, Pa. Circle No. 1-5.

New Toledo Power Drive Operates Hand Pipe Tools

TOLEDO, O.—The new Toledo 88 Power Drive, designed for fast efficient operation of hand pipe threaders, cutters and reamers, is announced by Toledo Pipe Threading Machine Co. Aluminum housing reduces weight to 140 lb., and increases portability. The power drive converts hand tools to power in the shop or on the job anywhere. Capacity is ⅛- to 2-in. pipe, ¼- to 1½-in. bolts; with universal drive shaft, geared die stocks and cutters up to 12-in.

Advanced features contributing to quick and efficient operation include: New 3-jaw scroll chuck on front with 6 pinions for greater convenience; rear chuck with universal centering; Universal motor, ½ hp. forward and reverse, 25 to 60 cycle, AC or DC, any 110 volt light socket. Protective plate guards motor and gearing from damage; aluminum housing is one piece for added strength; can be mounted on bench or service truck or furnished with set of legs and tool tray as accessories. Circle No. 1-7.



Light weight power drive operates all types of hand pipe threading tools

Hydraulic Loader for Many Different Jobs

WICHITA, Kans.—The new Davis Hydraulic Loader, manufactured by Mid-Western Industries, Inc., is now available according to Charles J. Davis, president of the firm, who said: "We are offering a series of attachments with the loader that enable the owner to do a number of jobs he formerly could do only by purchasing expensive equipment that would do just that one job."

One of the attachments is the Davis Concrete Buster. This attachment is made by simply attaching a chisel plate to the 200 pound hammer on the post driver attachment. The hammer travels at the rate of 40 to 50 strokes per minute and does a tremendous job of tearing up a section of street or other concrete area. Other attachments available with the loader, in addition to the material bucket which comes with the loader, include an oversize utility bucket, a dozer blade and a crane. Circle No. 1-8 for more information.

Series of attachments enable owner of this new loader to do additional jobs

The Davis Loader is distributed nationally through farm equipment dealers and additional information can be obtained by writing direct to the factory, Mid-Western Industries, Inc., 1009 South West Street, Wichita, Kansas, or Circling No. 1-9.

• • •

New Hydraulic Tractor Shovel Has Large Capacity Bucket

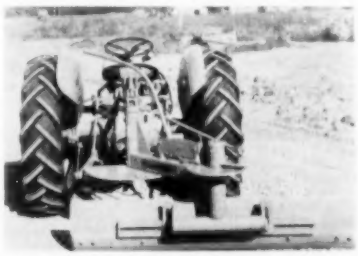
TOPEKA, KANS.—An addition to the family of hydraulic earth movers has been announced by Henry Mfg. Co. This hydraulic tractor shovel, of all-steel welded construction, has an extra-large capacity bucket which adapts itself readily to earth, mud, rock, sand, gravel, snow or any other loose and bulky material. Full information from Henry Mfg. Co., 1862 N. Clay St., Topeka, Kans. Circle No. 1-10.

New Henry hydraulic tractor shovel

• • •

"All-Position" Rear Blade Permits Ditching and Backfilling

TOPEKA, Kans.—A new suspension arrangement developed by Shawnee Mfg. Co. enables the operators of lightweight tractors to change the position of the rear dozer blade without leaving their seats. The blade can be extended to either side of the tractor, angled to either right or left. Maximum extension manually is 3 ft. beyond the wheels on either side. The blade is instantly reversible, and can be tilted to permit digging "V" drainage ditches. These features permit digging ditches in wet ground with the tractor wheels on solid footing. More information from Shawnee Mfg. Co., 1947-L, North Topeka, Topeka, Kansas, or Circle No. 1-11.



Backfilling blade has many uses

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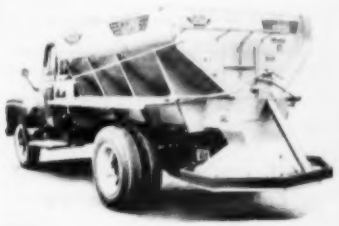
CEDAR RAPIDS, IA.—On the new 1954 model E sand, cinder, salt



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and chloride spreader of Highway Equipment Co., one hydraulic motor provides complete control of the width of spread, while a second motor gives completely independent control of the density of material. This means that, at any speed, the desired density can be applied to any width up to 80 ft. Well-controlled tests, using Grade CC rock salt, showed that either 2, 3 or 4 ounces per sq. yd. could be applied at speeds of 3, 8 or 15 miles an hour over a 40-ft. width. The spreader is completely cab-controlled, with one-man operation. Information on request to Highway Equipment Co., 645 D Ave., NW. Cedar Rapids, Iowa. Circle No. 1-12.

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Kerosene-gasoline operation for all its 2 KW and 3.5 KW manually started electric plants has been announced by the Kohler Co., Kohler, Wis. This unit includes a 1¼-gallon gasoline tank to provide gasoline for starting the L600 engine; a simple twist of a two-way valve transfers the fuel supply to kerosene when it reaches normal operating speed and temperature.

Permanent transparent coating penetrates, seals and waterproofs concrete, mortar, brick, steel and wood. It can be used as both primer and finish coat, and when sprayed on freshly poured concrete, it obviates the need of covering and wetting the concrete during curing. Delrac Corp., Watertown, N. Y.

The Universal Trencher is a recent development of the Heller Engineering and Manufacturing Co., Lynwood, Calif. It is specifically designed for mounting on the Oliver "OC-3" crawler tractor. Features include four-foot depth of excavation, digging width control, six digging speeds, adjustable and reversible soil conveyor, and hydraulically-controlled backfiller blade. This equipment is distributed exclusively through Oliver Equipment dealers in the United States and abroad.

A new line of contractors' air tools for 1954 is announced by Davey Compressor Co., Kent, Ohio, consisting of newly designed tools. Paving breakers are now being offered in 4 sizes from 35 to 90 lbs.; backfill tampers in 32 and 45 lb. types; and rock drills in 4 models, 28 to 58 lbs.

A 1 cu. yd. front end loader with torque converter has been added to the Pettibone Speedall Front-End Loader line as announced by the Construction Equipment Div. of

"Speedall" 1 cu. yd. front end loader

Pettibone Mulliken Corp., 4700 W. Division St., Chicago 51, Ill. This smaller capacity front end loader powered by gasoline (Model 10) or diesel (Model 10D) joins the 1½-cu. yd. Model 15 Series Speedall torque converter. These models provide inch-by-inch control through foot acceleration only, without shifting speeds or slipping clutch.

The non-electric magnetic road sweeper quickly removes nails, wire and other ferrous hazards to rubber-tired traffic on roads, airports and loading areas. These sweepers are available in standard sweeping widths of from four to eight feet. They cost nothing for electric power to operate and are ready for work at all times; they function in all kinds of weather and cannot cause shock to users or sparks; and operate efficiently on smooth and unpaved areas. Manufactured by Cesco, Santa Rose, Calif.

A resin cement has been developed by the Atlas Mineral Products Co., Mertztown, Pa., which has improved workability and is resistant to all alkalies, detergents, greases, solvents, oils, salts and non-oxidizing acids. It is non-toxic to the applicator, and can be applied at a rate approximately 50% faster than any resin cement available previously.

• • •

Patrol Patching Crew

Street patching crews patrol the streets of San Diego, Calif., locating and repairing holes in the streets. This system is said to be less costly than reliance on complaints since the repairs can be made before damage becomes serious, and the work is performed according to the actual need. Patrol crews composed of two men carry on surface patching work and special five-man crews handle work involving subgrade repairs.

Disaster Research Data Requested

The Clearinghouse of the Committee on Disaster Studies of the National Research Council writes: "We would like to receive reprints and reports, especially unpublished reports, on disaster studies, or on related research. We will also appreciate communication with the investigators of any 'in progress' studies. . . There is an urgent need by official agencies for scientific information on disaster problems. ." Address the Clearinghouse, at the National Research Council, 2101 Constitution Ave., Washington 25.

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Where to Obtain British Official Reports

At times we publish abstracts and excerpts from reports of water and sewage investigations conducted by the Water Pollution Research Laboratory of the British Department of Scientific and Industrial Research. In case any of our readers should wish to obtain the complete reports, they can get these from the British Information Services, 30 Rockefeller Plaza, New York 20, N. Y.

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Preventing the Freezing of Gas Mains

In Superior, Wisc., the high pressure gas mains of the Superior Water, Light & Power Co. are laid with a cover of 3 ft. Frost penetration is from 5 to 7 ft., so that the mains are in frozen ground for a good part of the year. When the gas pressure dropped, moisture separated from the gas and the mains froze. To prevent this, a Hortonsphere gas holder was constructed and all the gas from the high pressure compressors is discharged into this. Compression of the gas to 70 psi lowers the dew point sufficiently to eliminate condensation of moisture at the low soil temperatures required. During the past three years since the installation of this high-pressure storage there have been no frozen gas mains or services.

ASSOCIATIONS

INTER-AMERICAN Conference of Sanitary Engineering, the fourth, will be held in Sao Paulo, Brazil, July 25 to 31, 1954. During next year, Sao Paulo will celebrate its fourth centennial. For full information, address the General Secretariat, Interamerican Conference of Sanitary Engineering, Caixa Postal 8099, Sao Paulo, Brazil.

SEWAGE TREATMENT short course for operators will be given at the New England Field Training Center, on the campus of the University of Massachusetts, Amherst, March 22 to 26. More from Division of Training, Department of Public Health, 543 State House, Boston, Mass.

OHIO WATER CLINIC, the third annual meeting, will be held at the Ohio State University February 11 and 12. More information from Prof. Kenneth W. Cosens, Civil Engineering Department, OSU, Columbus 15, Ohio.

City Engineer Wanted

A city engineer is needed by a small city in Oklahoma. He will also serve as Director of Public Works. Initial salary $300 per month; $350 after July 1. Age limits 25 to 35; 2 years experience required for graduate engineer, 8 for non-graduate. Write Box 1-1, Public Works. Applications will be forwarded without acknowledgment.

Sales Representative Available

Top notch engineering salesman, highly recommended by Public Works, is available for covering Eastern Pennsylvania and possibly some contiguous areas. Write to Box 1-C, Public Works Magazine, 310 East 45th St., New York 17, N. Y.

BOOKS IN BRIEF

INDUSTRIAL WASTES

The Proceedings of the Second Southern Municipal and Industrial Waste Conference are now available in book form. This conference was held in Chapel Hill, N. C., March 19 and 20, 1953. The full texts of 25 papers are given in the 252-page book which is available from the Department of Sanitary Engineering, School of Public Health, University of North Carolina, Chapel Hill, N. C. $1.

CHEMICAL FEED MANUAL

A manual published by the Missouri Water & Sewerage Conference gives brief descriptions and shows pictures of chemical feed machines applicable to water and sewage treatment; and also contains data on chemical dosages, flow rates and chemicals used. $2.50 per copy from W. A. Kramer, Fourth Floor, State Office Building, Jefferson City, Mo.

WIND FORCES ON HIGHWAY BRIDGES

Scale models of highway bridges using 3 types of trusses and 3 types of plate girders were built and tested at 100 mph. in a wind tunnel. Results are compared with existing specification requirements which are found adequate in all cases and somewhat high for certain types.

Copy of this Special Report 10 can be obtained from Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C.

STRUCTURAL SHOP DRAFTING

This is the second volume of the Textbook of Structural Shop Drafting published by the American Institute of Steel Construction. It is suitable for use either as a text for the second year of a course in structural shop drafting, or as a reference for office practice. About 200 pages. $3. American Institute of Steel Construction, New York 17, N. Y.

NEW BOOK ON STATE TRAFFIC SAFETY

A comprehensive study of the organization, administration and programming of state traffic safety has been prepared by Maxwell Halsey, Executive Secretary of the Michigan State Safety Commission. In seven chapters the author sets forth the what, how and why of a safety organization and describes successful safety projects. This 230 page, paper bound book is available from the Eno Foundation for Highway Traffic Control, Saugatuck, Conn.

ECONOMIC EFFECTS OF HIGHWAY IMPROVEMENT

Bulletin 67 contains two papers. The first is a study of the effects of two Indiana bypasses on traffic operation, accidents, land use, land value and business in the communities affected. The other is a progress report of the effects of a new manufacturing plant on the economic pattern of a rural county of declining population and low income. Highway Research Board, 2101 Constitution Ave., Washington, D. C.; 45 cents.

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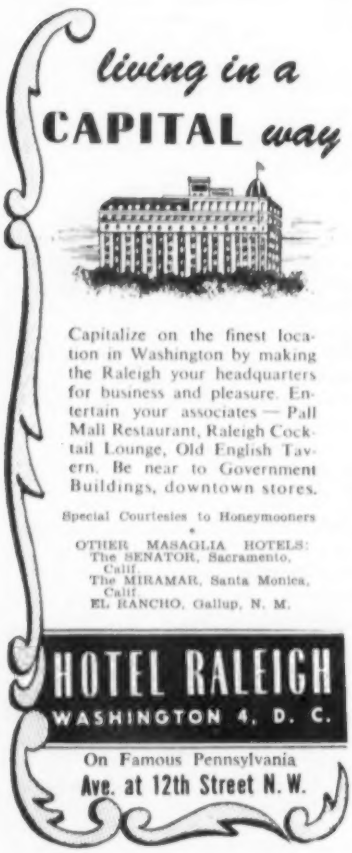
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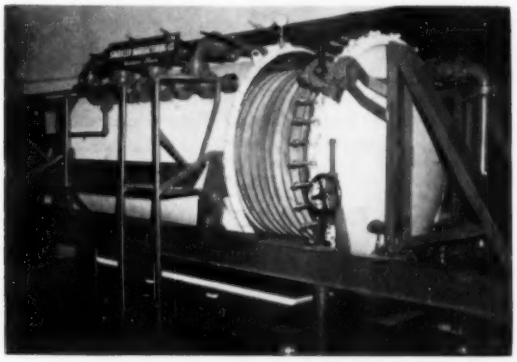
WORTH SEEING



One of the largest totally enclosed pressure filters in the world is shown here as it stood in the maker's booth—Sparkler Manufacturing Company, Mundelein, Ill.—at the December Chemical Show in Philadelphia. Capacity 140 cu. ft., 1,000 sq. feet area. Weight 21,000 lbs., if you care for figures. It's self-cleaning, automatic diatomite.

At 150th anniversary dinner of R. D. Wood Company in Philadelphia Nov. 10th this cast iron man assembled from Wood pipe fittings stole the show. His guard of honor, left to right: Theodore V. Wood, vice president of the host company; Henry E. McWane, president Lynchburg Foundry Company; N. F. S. Russell, chairman of the board and C. S. Lawson, president, United States Pipe and Foundry Company; John D. Capron, president, Glamorgan Pipe and Foundry Company; and Otto Hodges, president American Cast Iron Pipe Co.

This pedestrian got across! Scene is in Times Square, New York. Spots before your eyes are Dur-O-Line traffic markers made of Eastman Chemical Products Tenite plastic. More than 2,000,000 vehicles a month have passed over these. See Traffic Safety Supply Co., Portland 12, Oregon for yours.

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for
PURE WATER
354 B. C.
"Hippocrates' sleeve" (a cloth straining bag) was a popular water treatment method in the 4th Century B. C.
For excellence in MODERN water treatment equipment
—gravity and pressure filters—recirculation apparatus...
MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

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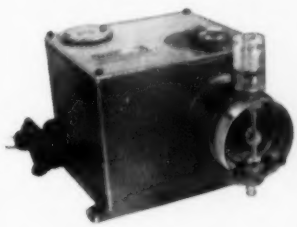
PRECISION
Chemical Pumps



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Accurate, dependable, positive displacement, diaphragm type pumps. Constant rate or meter paced for automatically variable output.

Precision Machine Company
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TAYLOR COMPARATOR

for pH, CHLORINE TESTS"

That's what water works operators say in plants all over the country. Taylor Comparators give fast, easy determinations of pH, chlorine, bromine, also complete water analysis. You can make determinations anywhere in plant since Taylor Sets are lightweight, small, no trouble to carry.

EASY TO USE Operate by colorimetric comparison method. No single standards to handle. Each complete set of standards in single plastic slide.

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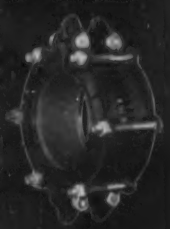
SKINNER-SEAL Bell Joint Clamp for stopping bell and spigot joint leaks under pressure. Gasket is completely sealed: at bell face by Monel Metal Seal band — at spigot by hard vulcanized gasket tip. 2" to 42".

AND BROKEN MAINS

SKINNER-SEAL Split Coupling Clamp. One man can install in 5 to 15 minutes. Gasket sealed by Monel band. Tested to 800 lbs. line pressure. A lasting repair. 2" to 24" incl.



M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

WORTH TELLING

by Arthur K. Akers

★ **GAR WOOD INDUSTRIES, INC.** has organized the Mattoon Division to handle production of Gar Wood bulldozers and scrapers sold through Allis-Chalmers industrial tractor distributors.

★ **DARLING VALVE & MANUFACTURING COMPANY,** Williamsport, Pa., appoints M. Stuart Evans eastern regional sales manager, in New York; and Joseph T. Cowan, district representative in Tulsa.

★ **EUTECTIC WELDING ALLOYS CORPORATION** gave a party and showing at their Flushing, L. I., plant of how they have "licked the problem of welding cast iron." We came away convinced. We also voted twice for "Miss Eutectic Welding of 1954." Only a blind man could have voted against either of the eyefilling contestants.

★ **CHICAGO BRIDGE & IRON COMPANY** opens a Salt Lake City sales office at 500 West 17th South Street, with J. Graham Daniels, formerly at Tulsa, in charge.

★ **LE ROI COMPANY,** subsidiary of Westinghouse Air Brake Company, names Hugh M. Little a vice president.

★ **MADISON L. CRAWFORD** now heads the advertising department of Frank G. Hough Company, succeeding Ray Wiggers who has gone on to his own advertising agency in Chicago. Mr. Crawford, a University of Michigan alumnus, comes to Hough from General Foods and Clark Equipment Company.

Mr. Crawford

★ **WEATHERCASTS OF AMERICA,** has opened eastern district offices at 39 Broadway, New York. We need more reliable weather forecasts (and weather) in this part of the country, and Weathercasts state that the former is their business.

★ **PIPE LININGS, INC.** takes over SOMASTIC Division, handling Centriline and Tate process cement lining of pipe in the 11 far western states.

Mr. Barrows

★ **HOWARD F. BARROWS,** advertising manager and research director for the Austin-Western Company, Aurora, Ill., is an outstanding example of how an advertising man can be far more than that. At the national convention of the Soil Conservation Society of America in Colorado Springs he was made an honorary member.

Of him it was said "he has sought out all the ways and means in which heavy earth-moving equipment could be most effectively used in soil and water conservation work." He fathered the Society's first booklet, "Down the River," of which over 200,000 copies have been distributed. He has just completed his *first* forty years with Austin-Western.

★ **NEIL POHL** has the newly created position of Allis-Chalmers' motor grader sales manager, at Milwaukee.

★ **BAKER MANUFACTURING COMPANY** of Springfield, Ill., has awarded contract to Luria Engineering Company, Bethlehem, Pa., for a new 40,000 square foot manuturing plant to be erected soon at Beardstown, Ill. It will concentrate on production of Baker snow plows but help with earth-moving and highway-building equipment manufacture, too. George Phares, Baker veteran, will be works manager.

★ **JOHN L. NORTH** has been named assistant to the sales manager, Marlow Pumps at Ridgewood, N. J.

★ **HERB SHRINER** says the new atomic submarines will only surface once every three years, for the boys to re-enlist.

Get them all... in one!

OLIVER "OC-3"

TRACTOR-LOADER

Quick change does it! In minutes, the "OC-3" tractor-loader converts easily to any of the tools shown here. You beat the cost of separate equipment for each job. You operate year-round in any ground condition doing more work... saving time, eliminating delays. The simple controls, all-hydraulic loader and maneuverability of this unit let you work where larger tractors cannot reach. Savings on equipment, hauling costs, (takes only a light trailer or truck) to say nothing of fuel economy, will pay for your "OC-3" tractor-loader in a short while.

Write today for a copy of a new folder on the "OC-3" tractor-loader, or visit your Oliver Industrial Distributor for complete details.

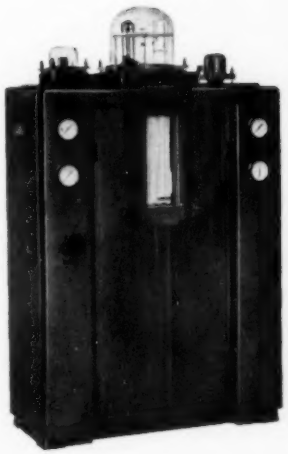
THE OLIVER CORPORATION

400 West Madison Street, Chicago 6, Illinois

a complete line of industrial wheel and crawler tractors

well "founded" beauty...

The Eiffel Tower's 984 feet of delicate, graceful beauty has stood the test of time because the interlaced ironwork structure is firmly anchored to four concrete corner-foundations.



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. . . Both the beauty of their smooth, modern lines and their time-proved, always dependable accuracy are well founded in the essentials of reliable equipment: — adequate research and development, a trained field staff, modern manufacturing techniques and a full line of designs to meet every need.

Take, for example, the reseach and development staff. Trained chemists and engineers are working continually to solve new problems with chlorination: to improve existing processes; and to design new equipment and controls. This staff is behind each W&T Chlorinator — your assurance you will get the *best in equipment* and the latest in plant processes.

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